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US Army Corps of Engineers
Seattle District

PSDDA Reports

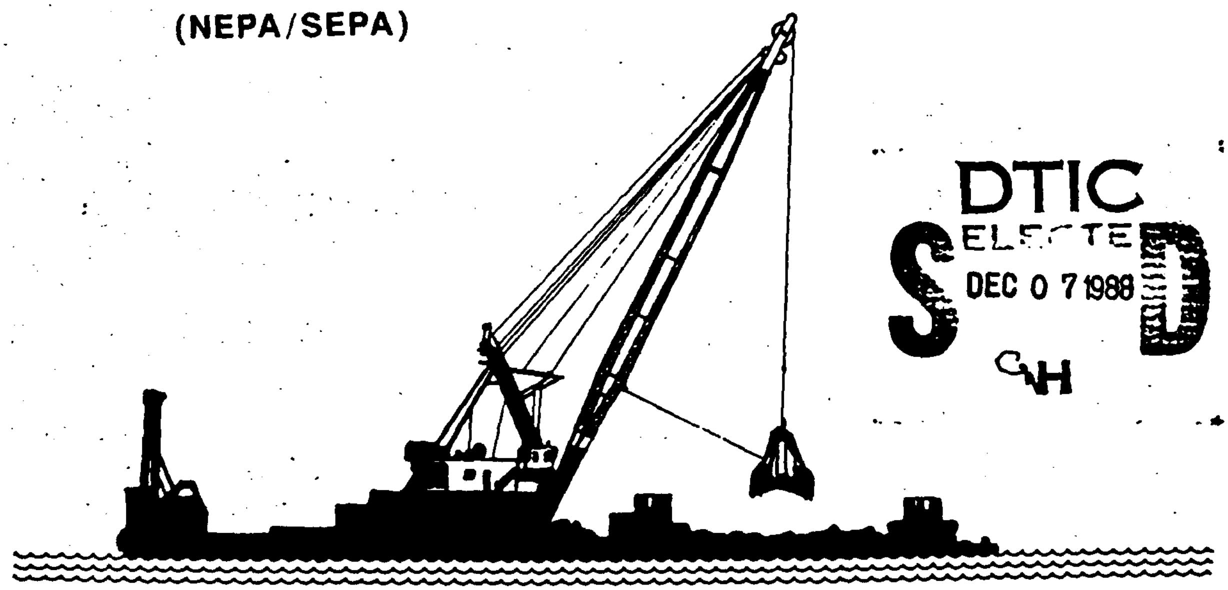
Puget Sound Dredged Disposal Analysis

(1)

Washington State Dept. of Natural Resources

FINAL ENVIRONMENTAL IMPACT STATEMENT - UNCONFINED OPEN-WATER DISPOSAL SITES FOR DREDGED MATERIAL, PHASE I (CENTRAL PUGET SOUND)

(NEPA/SEPA)



88 12 7 032

JUNE 1988

EPA
Region 10

ECOLOGY

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION unclassified	1b RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION / 6b. OFFICE SYMBOL *(If applicable)*	7a. NAME OF MONITORING ORGANIZATION US Army Corps of Engineers, Seattle District
6c. ADDRESS *(City, State, and ZIP Code)*	7b. ADDRESS *(City, State, and ZIP Code)* PO Box C-3755 Seattle, WA 98124-2255
8a. NAME OF FUNDING/SPONSORING ORGANIZATION / 8b. OFFICE SYMBOL *(If applicable)*	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS *(City, State, and ZIP Code)*	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE *(Include Security Classification)*
Unconfined open-water disposal sites for dredged material in Central Puget Sound, Phase I. Vol. I

12 PERSONAL AUTHOR(S)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT *(Year, Month, Day)*	15 PAGE COUNT
Final EIS	FROM ______ TO ______	June 1988	5 volumes, various paging

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
FIELD	GROUP	SUB-GROUP	Dredging, Open-water disposal Puget Sound

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

This final environmental impact statement evaluates alternatives considered in identifying preferred sites for disposal of dredged material in Central Puget Sound. Three public multiuser disposal sites (Commencement Bay, Elliott Bay, and Port Gardner) are identified for use based on a site selection process which considered several alternative sites. Alternative biological effects conditions for site management have been considered and a site condition identified for purposes of dredged material management at the Phase I sites.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION unclass.
22a. NAME OF RESPONSIBLE INDIVIDUAL Pat J. Perry	22b TELEPHONE *(Include Area Code)* (206)764-3728 / 22c. OFFICE SYMBOL CENPS-IM-CA-LB

UNCONFINED, OPEN-WATER DISPOSAL SITES
FOR DREDGED MATERIAL,
PHASE I (CENTRAL PUGET SOUND)
PUGET SOUND DREDGED DISPOSAL ANALYSIS

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)/
STATE ENVIRONMENTAL POLICY ACT (SEPA)

FINAL
ENVIRONMENTAL IMPACT STATEMENT

JUNE 1988

NEPA/SEPA
FINAL ENVIRONMENTAL IMPACT STATEMENT

COVER PAGE/FACT SHEET

Project Title. Unconfined, Open-Water Disposal Sites for Dredged Material, Phase I (Central Puget Sound), Puget Sound Dredged Disposal Analysis (PSDDA).

Program Description Abstract. This final environmental impact statement (FEIS) evaluates alternatives considered in identifying preferred sites for disposal of dredged material in central Puget Sound (Phase I area of the PSDDA study shown in figure 1).

Three public multiuser disposal sites (Commencement Bay, Elliott Bay, and Port Gardner) are identified for use based on a site selection process which considered several alternative sites. Alternative biological effects conditions for site management have been considered and a site condition identified for purposes of dredged material management at the Phase I sites.

Documents Adopted by Reference. The PSDDA Management Plan Report (MPR) is adopted by reference as part of this FEIS.

Principal Agencies.

U.S. Army Corps of Engineers, Seattle District (Corps)
U.S. Environmental Protection Agency, Region X (EPA)
Washington Department of Natural Resources (DNR)
Washington Department of Ecology (Ecology)

Proposed Date for Implementation. October 1988.

Lead and Cooperating Agencies for National Environmental Policy Act/State Environmental Policy Act Action. The FEIS was prepared as a joint National Environmental Policy Act (NEPA)/State Environmental Policy Act (SEPA) action by the principal agencies (pursuant to 33 CFR 230.20).

NEPA Lead Agency:	Corps	NEPA Cooperating Agency:	EPA
SEPA Lead Agency:	DNR	SEPA Cooperating Agency:	Ecology

Responsible Officials.

Corps: Colonel Philip L. Hall
District Engineer
Seattle District, Corps of Engineers

DNR: Brian Boyle, Commissioner Public Lands
Washington Department of Natural Resources

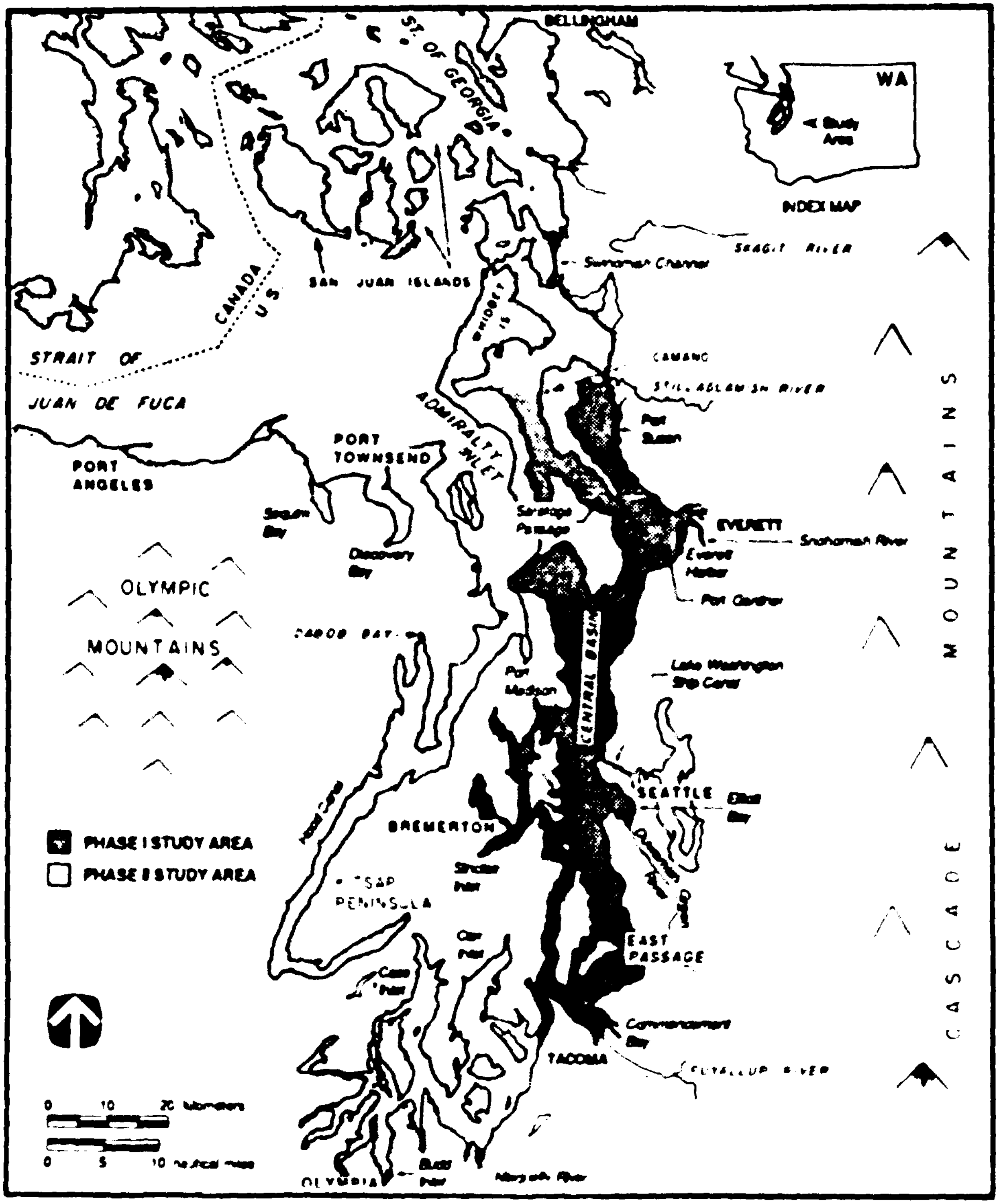


Figure 1. Puget Sound, Washington
Puget Sound Dredged Disposal Analysis Study Area

EPA:	Robie G. Russell Regional Administrator EPA, Region X	Ecology:	Christine O. Gregoire, Director Washington Department of Ecology

Contact Persons.

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Additional Actions Required. Designation and eventual use of the sites will require the following actions:

Responsible Entity	Action
U.S. Army Corps of Engineers, Seattle District	40 CFR 230.80 - Federal Advanced Identification of Disposal Sites Sections 10 and 404 Permits for Specific Dredging Projects (for disposal site use)
U.S. Environmental Protection Agency, Region X	40 CFR 230.80 - Federal Advanced Identification of Disposal Sites
Washington Department of Natural Resources	Dredged Material Disposal Permits for Specific Dredging Projects (for disposal site use)
Washington Department of Ecology	Section 401 Water Quality Certifications for Specific Dredging Projects (for disposal site use)
Washington Departments of Fisheries and Wildlife	Hydraulics Project Approvals for Specific Dredging Projects (for disposal site use)
City of Seattle, City of Everett, and Pierce County	Shoreline Substantial Development Permits for the Disposal Sites Within Each Jurisdiction

Subsequent Environmental Review. After completion of the Phase I portion of the PSDDA study, individual dredging projects where unconfined, open-water disposal at the identified sites is being proposed, will be reviewed for compliance with the appropriate regulatory requirements, as specified above.

Authors - Principal Contributors to the Final EIS. Staff of the principal agencies prepared the PSDDA FEIS with advice and input from other agencies, local governments, ports, Indian tribes, various organizations, and private citizens who served on three technical work groups. See section 7 of the environmental impact statement (EIS) for a list of specific contributors to the EIS.

Cost of Reports. The FEIS is available at no charge by calling the person (or writing to the address) shown below.

Management Plan Report and Final EIS Issue Date: Publication of Notice of Availability in Federal Register (anticipated July 15, 1988).

Time and Place of Final Public Meetings. The final public meetings on the draft EIS and supporting documents were held:

7:30 p.m., Wednesday
10 February 1988
Joint Use Auditorium
Federal Center South
4735 E. Marginal Way S.
Seattle, Washington

7:30 p.m., Thursday
11 February 1988
City Hall, Council Chambers
Port Townsend, Washington

Date Final Action Planned.

Federal agencies - completion of the Federal Record of Decision (fall 1988)

State Agencies - Issuance of the shoreline permits for the selected disposal sites (summer/fall 1988)

SUMMARY

This Final Environmental Impact Statement (FEIS) evaluates alternatives considered in selecting public multiuser unconfined, open-water sites for the disposal of dredged material in the Phase I area of the Puget Sound Dredged Disposal Analysis (PSDDA), a comprehensive study of unconfined dredged material disposal in deep waters of Puget Sound. The study is being undertaken as a cooperative effort by the U.S. Army Corps of Engineers (Corps), U.S. Environmental Protection Agency (EPA), and the State of Washington Departments of Natural Resources (DNR) and Ecology (Ecology). A management plan for the Phase I area (central Puget Sound) has been prepared which identifies selected unconfined, open-water disposal sites, evaluation procedures for dredged material being considered for disposal at these sites and site management considerations including environmental monitoring. This summary contains information from both the environmental impact statement and the Management Plan Report (MPR) which has been adopted as part of the FEIS by reference.

PUGET SOUND NAVIGATION AND DREDGING

Navigation waterways of Puget Sound have played a vital role in the region's economic development and growth. Combined Port of Seattle and Port of Tacoma activity produces over 70,000 jobs and an annual business volume of nearly $4 billion. There are 34 port districts serving the region. Some 50 miles of navigation channels, about 50 miles of port terminal ship berths, and more than 200 small boat harbors must be periodically dredged to maintain the commercial and recreational services provided by these facilities. Over the period 1970-1985, an estimated 24.8 million cubic yards (c.y.) of sediments were removed from Puget Sound harbors and waterways by various dredgers. These included private developers and public entities (e.g., Federal and State agencies, ports, and local governments) responsible for funding and undertaking dredging projects. To place this activity in some perspective, periodic dredging for navigation improvement and maintenance projects occurred in only an estimated 0.08 percent or less than 2 square miles of the total 2,500 square mile surface area of Puget Sound.

PUGET SOUND DREDGED MATERIAL DISPOSAL

Historic Practice. During early development of Puget Sound waterways, dredged material was often used as a convenient source of fill material for associated harbor and terminal improvements. This practice has continued, but at a much lesser rate in recent years, as public policy has been to protect environmentally important tidal areas, wetlands, and marshes. Consequently, nearshore disposal options are limited. Upland disposal is quite costly and may also have adverse environmental impacts. In the future, for many projects, disposal in deep and relatively deep marine waters is expected to be a preferred option for environmental, as well as economic, reasons.

Public Unconfined, Open-Water Disposal Sites. Until 1970, dredged material disposal in Puget Sound was discharged at sites generally selected by each

dredger. At that time, disposal site designation guidelines were formulated by an interagency committee chaired by DNR, and more than 10 specific public multiuser disposal sites were established. Nearly all unconfined, open-water disposal has since occurred at these sites. In the 1970-1985 period, about 9 million cubic yards or approximately 36 percent of the total material dredged was released at the designated disposal sites with most of the remaining material used as an economic source of landfill even though much of it would have been acceptable for open-water disposal. When compared with the 250-300 million c.y. of sediment that were discharged by the rivers flowing into Puget Sound over this same period, it can be concluded that only about 2 percent of the total annual sediment loading was due to dredged material disposal from new projects. Maintenance dredging adds no additional sediment loading.

Key Regulatory Authorities. Section 404 of the Federal Water Pollution Control Act (FWPCA) Amendments of 1972 established a permit program, administered by the Secretary of the Army. This program is used to regulate the discharge of dredged material into waters of the United States. It also is used to specify disposal sites in accordance with Section 404(b)(1) Guidelines developed in interim final form by EPA in 1975. The Guidelines concentrated on specifying the tools to be used in evaluating and testing the impact of dredged or fill material discharges on waters of the United States. In 1977, the FWPCA was substantially amended as the Clean Water Act (CWA). In 1980, EPA, in conjunction with the Corps published final Guidelines for the specification of disposal sites for dredged or fill material. These specify that the disposal of dredged material must not result in an "unacceptable adverse impact" to aquatic ecosystems. Simultaneously, proposed rules for testing requirements were published. Although final rulemaking has not taken place, the testing requirements and procedures have been implemented by the Corps as a matter of policy.

Congress granted to the States the responsibility for certifying under Section 401 of the CWA that a proposed discharge, resulting from a project described in a Corps public notice issued under Section 404 of the CWA, will comply with the applicable provisions of the State and Federal water quality laws. This certification is required for any Federal activity, and from any applicant for a Federal permit to conduct any activity, which may result in any discharge into State waters. Compliance with Section 401 also ensures that any such discharge will comply with the applicable provisions of Sections 301, 302, 303, 306, and 307 of the CWA and relevant State laws.

Dredged Material Research. Considerable nationwide research has been accomplished since the early 1970's through the Corps' Dredged Material Research Program (DMRP) in assessing the environmental effects of dredged material disposal. This research has been used by the Corps in making decisions on dredged material disposal. DMRP has shown that most dredged material is acceptable for open-water disposal and can have many beneficial uses, including fish and wildlife habitat development. As part of the DMRP, studies were conducted in Elliott Bay and elsewhere in Puget Sound. Puget Sound examples of beneficial use of dredged material include Jetty Island at Everett, clam habitat development at Oak Bay Canal, and a beach feed erosion control project at Keystone Harbor on Whidbey Island.

SITUATION LEADING TO PUGET SOUND DREDGED DISPOSAL ANALYSIS

Closure of Disposal Sites. The Fourmile Rock and Port Gardner disposal sites were closed in 1984, due in part to public controversy associated with use of these particular locations. While the Fourmile Rock site was reopened in 1985, it closed again in June 1987, when the shoreline permit for the site expired. The Commencement Bay site closed in June 1988. Accordingly, there are currently no unconfined, open-water disposal sites available in the Phase I area. This condition creates uncertainty with regard to future disposal of dredged material and highlights the urgency of having an acceptable dredged material disposal management plan if maintenance of navigation channels is to continue.

Past Dredged Material Evaluation. Until 1984, Puget Sound dredged material sampling, testing, and test interpretation requirements were established on a project by project basis. EPA and the Corps, in cooperation with Ecology, assessed non-Corps dredging projects. The Corps conducted the evaluations for federally authorized Corps navigation projects. (For the purposes of this report, federally authorized navigation projects include Corps projects authorized under various River and Harbor Acts as well as all other federally operated channels such as Navy, U.S. Coast Guard, NOAA, etc.) In the case of Corps navigation projects, Seattle District developed testing procedures for each project in cooperation with Ecology and EPA. These procedures, developed programmatically for Corps projects, were also required, as appropriate, for non-Corps permit applicants.

Case-by-case evaluations did not provide local authorities with sufficient assurance that aquatic resources at the disposal sites were being adequately protected. The Puget Sound area is unique relative to other regions of the Nation in that local governments also play a key role in dredged material disposal, through their shoreline master programs under the State shoreline permit process. Local jurisdictions can condition or restrict dredging and dredged material disposal.

The lack of fully consistent evaluation procedures, or specific objective decision criteria led, in part, to the establishment of interim disposal criteria by EPA and Ecology for the Fourmile Rock disposal site in Seattle's Elliott Bay in 1984 and the Port Gardner site near Everett in 1985. The Fourmile Rock criteria became a condition of the local shoreline permit issued by the city of Seattle and the Port Gardner criteria a condition of the city of Everett permit for the existing Port Gardner site. Subsequently, in 1985, Ecology developed the Puget Sound Interim Criteria (PSIC) to ensure that the other Puget Sound disposal sites did not experience similar problems. These criteria have been used in the interim pending development of regional Sound-wide guidelines for dredged material disposal.

Puget Sound Pollution and Contaminated Sediments. The past practice of discharging untreated or only partially treated industrial and municipal effluent into Puget Sound, combined with potentially harmful chemicals from a variety of other point and nonpoint sources, has resulted in the degradation

over time of the water and sediment quality in some areas of Puget Sound. Increasing scientific evidence about the harmful effects of pollution on the estuary has served to heighten public and agency concern about the long term environmental health of the estuary and the impact that various activities can have on the Sound's ecosystem. Recent efforts to establish better regulatory control of pollutants at their source have resulted in general improvements in water quality. Additionally, ongoing planning and cleanup actions by the Puget Sound Water Quality Authority (PSWQA), Ecology, EPA, local governments, and others are expected to further improve the marine environment. Concerns remain, however, because the sediments near industrialized and developed areas may remain contaminated from past waste discharge practices. This is because potentially harmful and persistent chemicals tend to bind to the sediment particles and settle to the bottom. While considerable improvements have been made, more remains to be done.

Data indicate that pollutants, which have entered the major harbor areas through various sources, have accumulated over time in a variety of shoreline areas, including navigation channels and vessel berthing locations. Dredging, in the process of maintaining the Sound's navigation system, must sometimes involve the removal and disposal of contaminated sediments.

The PSDDA study has recognized the requirement for dealing with contaminated sediments. However, the study focus has been primarily on disposal of the majority of dredged material which is expected to be found "clean" or uncontaminated, and therefore acceptable for unconfined, open-water disposal at designated public multiuser sites. These are locations where any dredger can dispose of dredged material, provided that the material has been evaluated and disposal approved by the appropriate regulatory agencies. A separate study by the State of Washington is underway which will address the specific requirements of dredged material found unacceptable for disposal at the PSDDA designated sites.

PUGET SOUND DREDGED DISPOSAL ANALYSIS (PSDDA)

Environmental and economic considerations are both major factors supporting the need for long range regional planning as a lasting, effective solution for dredged material disposal problems. No longer can disposal alternatives be planned independently for multiple projects in a given area. Regional dredged material disposal management programs offer greater opportunities for environmental protection, reasonable project costs, and greater public acceptance than total case-by-case decisionmaking. A dredged material disposal management plan for unconfined, open-water disposal has been developed through the PSDDA study. This plan is unique to the Puget Sound area because the data supporting many elements of the plan are Puget Sound based. Also the plan reflects the social values of this region and is responsive to the unique role from a national perspective, of local government, in the management of open-water dredged material disposal sites.

Study Scope. The Corps, EPA, DNR, and Ecology began the PSDDA study in April 1985. The study is a 4-year-long effort being conducted in two overlapping

phases, each about 3 years in length. As shown in figure 1, Phase I covers central Puget Sound, including the Sound's major urban centers, Tacoma, Seattle, and Everett. Phase II, initiated in April 1986, covers the north and south Sound areas, including Olympia, Port Townsend, Port Angeles, Anacortes, Bellingham, and other locations of dredging activity. Separate Phase II documents, including a DEIS, will be prepared and distributed during the fall of 1988 for public review and comment.

Study Goal and Objectives. The goal of PSDDA is to provide publicly acceptable guidelines governing environmentally safe unconfined, open-water disposal of dredged material, thereby improving consistency and predictability in the decisionmaking process. Public acceptability involves consideration of a wide range of factors. Among these are technically sound evaluation procedures and practicability, which includes cost effectiveness. Study objectives are to: (1) identify acceptable public multiuser unconfined, open-water disposal sites; (2) define consistent and objective evaluation procedures for dredged material to be placed at those sites; and (3) formulate site use management plans that will ensure adequate site use controls and program accountability.

Study Limitations. Although PSDDA is identifying specific disposal sites and site management plans for unconfined, open-water disposal, locations for conventional upland/nearshore sites and confined disposal sites (confined aquatic or upland/nearshore) are not being specified via PSDDA. There are several reasons for this. First, while disposal in Puget Sound revolves around many regionwide and statewide issues, disposal on land (especially for contaminated material) is very much associated with local government decisions regarding land uses. Second, the authorities of the various agencies involved in PSDDA (such as the CWA) are not as easily applied to land. And last, the State of Washington, in a recently initiated study, is addressing the confined disposal options and associated testing procedures, building on the work done through PSDDA.

An evaluation comparing the potential impact of dredged material disposal to the impacts of other water-related activities in Puget Sound is also beyond the scope of this study. However, due to the limited areas to be dredged and the conditions imposed by regulatory agencies, dredged material disposal at unconfined, open-water sites has very little potential for affecting the overall ecosystem of Puget Sound. This conclusion is supported by information derived from the PSDDA study and presented in study documents.

PSDDA PHASE I (CENTRAL PUGET SOUND)

Study Findings. The following are key findings of the PSDDA study for the Phase I area:

o About 22.7 million cubic yards (c.y.) of bottom sediments could be dredged from Phase I area harbors and waterways over the period 1985-2000 as compared to the 16.8 million c.y. removed between the years 1970 to 1985.

o A management plan has been prepared that addresses the needs of unconfined, open-water disposal including (a) disposal site locations, (b) site management conditions, (c) dredged material evaluation procedures, (d) disposal site management, (e) disposal site environmental response monitoring, and (f) dredged material data management.

o The management plan for the Phase I area meets the PSDDA goal and accomplishes each of the study objectives.

o Specific project by project evaluations, to be made under the Section 404(b)(1) Guidelines and Section 401 Water Quality Certification review, will establish actual dredged material volumes that can be placed in unconfined, open-water disposal sites. However, through the year 2000, based on PSDDA projections and estimates, about 11.2 million c.y. of future dredged material is expected to be found acceptable for unconfined, open-water disposal. This compares with 6.8 million c.y. of dredged material actually placed in Phase I waters over the past 15 years. In the past, not all acceptable material was placed at public disposal sites. Much was used for landfill or other beneficial purposes. This is anticipated in the future, too.

o The PSDDA preferred disposal sites can accommodate the projected volumes of acceptable dredged material well beyond the year 2000.

o More extensive dredged material sampling and testing will be required than in the past, as well as improved disposal site management, including increased permit compliance inspections and environmental monitoring of site impacts. Overall, the cost of dredged material disposal is anticipated to be higher than it was prior to the establishment of the EPA/Ecology interim criteria, but less than that experienced under the interim criteria. More dredged material is expected to be found acceptable for unconfined, open-water disposal under PSDDA evaluation procedures as compared to the interim criteria. Other disposal options, including confined aquatic capped, nearshore, and upland disposal are generally much more expensive because of greater handling and transport requirements, and the increasing difficulty in securing acceptable site locations. From a regional standpoint, the reduced disposal costs are expected to more than compensate for increased costs of sampling, testing, and disposal site management.

o Overall, more extensive and rigorous testing and monitoring resulting from PSDDA is expected to be less costly than if the PSIC were used entirely throughout Puget Sound. However, the PSDDA testing and monitoring costs and costs associated with more material requiring confined disposal than was the case prior to PSIC, will be significantly higher. The aggregate of these increased costs may result in some projects either not being dredged in the future or dredged at a reduced level. This could have a disruptive or adverse impact on the affected interests. Similarly, depending on the specific port or commodity(ies) involved, there is a potential for commodity and route shifts which may in turn have localized economic and social impacts. Such impacts will be less than if "No Action" or PSIC were to be implemented. It is not possible to quantify either the impacted interests nor the magnitude of the economic or social impacts.

o Environmental consequences were considered as various elements of the management plan were addressed. This is reflected in the locations chosen for the selected disposal sites, as well as the biological effects condition chosen for site management. Environmental impacts resulting from disposal at the selected sites are not expected to be significant, as discussed in this PSDDA Phase I FEIS.

o The PSDDA plan, while unique to the Puget Sound area, fully complies with the Clean Water Act and its objectives to restore and maintain the environmental quality of the Nation's waters. Also it is intended to be in consonance with all applicable State and Federal laws and the PSWQA-adopted 1987 Puget Sound Water Quality Management Plan.

o Indian treaty fishing rights were addressed as part of the PSDDA process.

Management Plan. Key elements of the PSDDA Management Plan for the Phase I area are:

o Public Multiuser Unconfined, Open-Water Disposal Sites. Three public multiuser unconfined, open-water disposal sites have been selected which will partially satisfy the future dredged material disposal needs of the Phase I area. Because the Phase I area contains the major urban and industrialized centers of development, where significant waste discharges have occurred, only about 60 percent of this area's future dredged material may be found acceptable for unconfined, open-water disposal. This compares with 90 to 95 percent nationally. The estimate of acceptable material for the Phase I area is based on existing, primarily surface sediment data, which reflects areas of higher contamination. Actual volumes may be more or less, and will depend on test results and subsequent evaluations by regulatory agencies.

An unconfined, open-water disposal site has been located in each of the Tacoma, Seattle, and Everett urban embayments of Commencement Bay, Elliott Bay, and Port Gardner, respectively. The sites, while varying in size primarily due to bathymetry, average about 350 acres in potential bottom impact area. Each site includes a 900-foot radius, 58-acre surface disposal zone within which all suitable dredged material must be released.

The selected disposal sites are all located in areas relatively free of important biological resources and human use activities. Particularly valuable and unique resource areas were avoided. The center of the Commencement Bay disposal zone is located approximately 1 mile west of Browns Point, in water about 550 feet deep. In Elliott Bay, the center of the disposal zone is located about 3/4 of a mile north of Harbor Island, in water 265 feet deep. The center of the Port Gardner disposal zone is located about 2-1/4 miles southeast of Gedney Island, in approximately 420 feet of water.

o Site Management Condition. Alternative site management conditions were evaluated in recognition that some environmental impacts may be associated with use of the disposal sites. These management conditions relate to the potential for long-term chemical effects that might be allowed on biological resources, due to dredged material disposal. Short-term physical impacts that will occur due to burial, are accepted as part of site use. The selected management condition for the Phase I sites could allow up to "minor adverse effects" on biological resources that may be present or move across the disposal sites. However, because only acceptable sediments will be discharged at the disposal sites, the aggregate condition of each site is expected to be substantially better than allowed under the selected management condition (site condition II).

o Evaluation Procedures. Comprehensive dredged material evaluation procedures governing sampling, testing, and test interpretation (disposal guidelines) have been developed through PSDDA to ensure that conditions at the disposal sites are consistent with site management objectives. The evaluation procedures are intended to be used, as appropriate, in support of assessments of specific projects conducted under the Federal Section 404(b)(1) Guidelines and under the State of Washington guidelines used in evaluating projects for Section 401 Water Quality Certifications. Other provisions of the CWA confirm the authority of the Secretary of the Army to maintain navigation by stating that this authority is not affected or impaired by provisions of the Act (33 U.S.C.A. 1344(t) and 33 U.S.C.A. 1371(a)).

o Site Management Plans. Disposal site management plans have been formulated to address navigation and discharge conditions of disposal permits, and subsequent disposal site environmental monitoring. The monitoring plan is intended to ensure that acceptable conditions at the site are not exceeded and to provide a basis for any necessary plan adjustments.

Alternatives. This FEIS describes and evaluates the selected and alternative disposal sites. Also discussed are alternative biological effects conditions considered for disposal site management. Site management includes the application of evaluation procedures to assess the acceptability of dredged material for unconfined, open-water disposal. The evaluation procedures are described in the accompanying MPR. A No Action alternative, which would continue use by Ecology and EPA of the PSIC for dredged material disposal, is presented in the FEIS. This alternative would result in very limited unconfined, open-water disposal in Puget Sound due to both the application of the PSIC and the discontinuation of public multiuser disposal sites. The latter would occur because local governments have established shoreline permit conditions for a multiuser site that probably could not be met by most dredgers. These conditions require that comprehensive treatment be given to dredged material disposal including all the objectives addressed by PSDDA. Few dredgers have the necessary resources to accomplish this.

The No Action alternative could result in no dredging for some projects as other disposal options may be cost prohibitive. Social impacts could include lost employment and reduced property values. Some adverse environmental

impacts may also occur during the construction of new facilities even if those areas where marine facilities are relocated to waters accessible to navigation without dredging.

o Alternative Disposal Sites. The alternative disposal site in Commencement Bay overlaps the selected site on the north, and ranges in depths from 540 to 560 feet of water. The alternative site has somewhat higher currents than the selected site. Currents are important considerations in that low current areas tend to be locations where sediments naturally settle out of the water. Therefore, dredged material placed at these locations (depositional areas) would tend to stay there. This facilitates environmental monitoring of the site which allows verification of site conditions.

The alternative disposal site in Elliott Bay lies southwest of DNR's existing diposal site called Fourmile Rock, approximately 4,000 feet south of Magnolia Bluff. The alternative site is located in water depths ranging from 500 to 600 feet. While the currents along the bottom are generally low, they are, however, greater than at the selected site.

The center of alternative site No. 2 in Port Gardner is located 9,000 feet southwest of the mouth of the Snohomish River and 4,000 feet from shore, in water depths that vary from 320 to 420 feet. This alternative site is located just north of the existing Port Gardner DNR disposal site. Though also in a low current area as is the selected site, aquatic resources are more abundant and closer here than at the selected site. In addition, approximately one-half of this site may be covered by the U.S. Navy's Revised Application Deep Confined Aquatic Disposal (RADCAD) site, which the Navy has been permitted to use as their disposal site for material generated by the new Navy Homeport facility.

Alternative site No. 3 for the Port Gardner area is located in Saratoga Passage, approximately 1 nautical mile from either shore on the east and west. Water depth is approximately 350 feet. This area has the lowest bottom currents of any site investigated, but proximity of proposed aquaculture facilities, along with the additional transport distance from major dredging areas, make this site less suitable.

o Alternative Biological Effects Conditions for Site Management. The selected biological effects condition for site management was developed based on evaluation of the potential effects to biological resources that could result from the unconfined, open-water disposal of dredged material in Puget Sound waters. Alternative site conditions were derived using field and laboratory data to determine varying levels of sediment quality and potential biological effects at the disposal site. Three alternative site conditions, describing the potential impacts on biological resources at the site, were carried through the entire study. They range from "no" effects to "moderate" effects resulting from the type of dredged material that could be placed at the sites:

a. Site Condition I: "No" adverse effects to site biological resources due to sediment chemicals of concern.

b. Site Condition II: "Minor" adverse effects to site biological resources due to sediment chemicals of concern.

c. Site Condition III: "Moderate" adverse effects to site biological resources due to sediment chemicals of concern.

These site conditions represent three potential mutually exclusive alternatives for the selected biological effects condition at the Phase I disposal sites. Only one of these conditions was chosen for use at all the Phase I sites, based on agreement of the regulatory agencies and upon public input and review. The selected site management condition for the Phase I sites is Site Condition II.

Environmental Analysis. The disposal sites were selected based on careful consideration of a number of factors, including biological resources, human uses, physical parameters and haul distances from dredging projects. The selected sites are in locations where significant adverse environmental impacts to the quality of the human environment (per NEPA) are not anticipated and human use conflicts have been minimized to the maximum extent practicable.

The environmental impacts associated with alternative biological effects conditions for site management were also examined. The selected site management condition will not result in unacceptable adverse impacts. A full discussion of the environmental impacts associated with the alternatives is contained in this FEIS. An EIS was prepared to "encourage and facilitate public involvement in decisions which affect the quality of the human environment" (40 CFR 1500.2).

The selected alternatives for the Phase I area result from the use of site management condition II at the site selected for each of the three major dredging areas. The environmental consequences of the selected alternatives are summarized below.

Some localized reductions in air quality may occur in the vicinity of the unconfined, open-water disposal sites, primarily due to exhaust emissions from the internal combustion engines of the disposal equipment. Localized increases in noise levels may also occur during disposal operations. These adverse effects from noise, and to air quality, at the disposal sites will be short term, intermittent, and relatively buffered from other human uses, and are therefore not considered significant. Long-term or persistent adverse effects are not anticipated.

Temporary reductions in water quality at and around the disposal sites will occur during disposal operations. These will include minor depression of dissolved oxygen, increases in turbidity, and release of organic matter and sediment-associated contamination. These effects will be primarily associated with the disposal plume. Though they may be measurable throughout the water column, the effects will be most noticeable in the bottom layer, near the sediment/water interface (the nepheloid layer). For dredged material that is acceptable for unconfined, open-water disposal, these adverse effects to water

quality will be minor and temporary, with rapid dilution or dispersion subsequent to disposal. In general, turbidity associated with disposal operations is substantially less than that occurring during riverine, high-water discharge periods, or from vessel passage in navigation channels. The latter situation occurs when the vessel bottom is near the bottom of the waterway. Disturbance is caused by propeller action or vessel induced currents. Significant or unacceptable effects are not anticipated.

Environmental consequences from unacceptable sediment quality at the disposal sites have the potential to be persistent and long term (assuming continued use). As measured by concentrations of sediment chemicals, the quality of sediments may either decrease or increase at the disposal sites, depending on the present site sediment chemical levels (e.g., sediment quality of portions of the Elliott Bay and Commencement Bay sites would likely improve with use). For the Port Gardner site, a decrease in sediment quality within this site is expected, given the relatively undisturbed existing nature of this area.

While the PSDDA selected site management condition (Condition (II) would allow sublethal adverse effects to occur at each of the disposal sites, this degree of adverse effect is generally not anticipated, given the nature of the material placed at these sites. Because only acceptable sediments will be discharged at the disposal sites, the aggregate condition of each site is expected to be substantially better than allowed under the selected management condition.

State water quality standards (WAC 173-201) will be met by site condition II. At each disposal site a dilution zone will be established. The dilution zone will include the disposal site and area between the disposal site boundary and the perimeter line established for monitoring the disposal site. Individual project water quality certifications, authorizing the discharges, will reference the dilution zone where no acute conditions to the aquatic biota will be allowed (WAC 173-201-035(4)(a)). Site condition II meets this standard. In summary, adverse effects to the quality of sediments resulting from the PSDDA alternatives are not expected to be significant.

Designation and use of the disposal sites will result in periodic burial of a portion of the subtidal bottom area of central Puget Sound in each of the respective bays. Due to this periodic physical disruption of the sites, these areas will be intermittently removed from benthic production. These losses are not considered significant, as the sites are located to minimize adverse biological effects.

Benthic, sessile (immobile) species present at the center of the unconfined, open-water sites will be buried during discharge of dredged material. This will result in a loss of some organisms, especially in those areas of the disposal site where the burial depths are greater than that which the organisms can penetrate. At the more active sites (e.g., Elliott Bay), continued physical disruption of the site will impair any substantial recovery in these areas while the site is in use. However, some site recolonization by benthic species will be likely between disposal operations. Some recolonizers

may experience minor increases in body burden levels of chemicals within the site. These levels will not result in significant acute toxicity to these species, nor will the levels exceed values considered to be harmful to human health. Though net losses of benthic production in the sites are considered long term, sites have been located to prevent significant adverse effects to the aquatic ecosystem as a whole.

The relatively few bottom-feeding fish and mobile shellfish (crabs and shrimp) utilizing the unconfined, open-water disposal sites are expected to be temporarily displaced from portions of the sites where disposal has most recently occurred. The displaced epifauna could experience some reduced survival to the extent that the overall ecosystem in the vicinity of the site is at carrying capacity. In addition, less mobile individuals within the site (or perhaps partially dug into the surface of the site) will be buried and lost. As the sites were located away from areas where these species concentrate, the displacement and resulting effects should not be significant.

Disposal activities, with barge and tug passage and associated noise, will displace birds found at the disposal sites during the very short time of individual disposal operations. Though much less common, any marine mammals found in the area will also be displaced. Given the existing level of navigation traffic found at and near the sites, this temporary displacement is not expected to result in significant effects to these species.

Compared to the No Action alternative, tug and barge traffic to and from the disposal sites will have a greater potential for conflicts with recreational and commercial fisheries in each of the bays. All three of the selected sites are located within the usual and accustomed fishing grounds (as of 1974) of several Puget Sound tribes. However, the potential conflicts with Indian fishing activities have been addressed in this FEIS. Appropriate project specific actions will be taken to avoid any conflicts with tribal fishing operations.

The estimated volumes of dredged material that might be discharged at the unconfined, open-water disposal sites are shown in tables 1a, 1b, 1c, and 1d. These tables are based on the following simplifying assumptions: (1) for a given site management condition, no dredged material would be discharged at the site that would result in that site condition being violated, and (2) all material that would be acceptable for discharge at the sites would be placed there. Each of the tables also gives, for comparison purposes, the estimated volume of dredged material that could be found acceptable for unconfined, open-water disposal under PSIC. The cost consequences to dredging and dredged material disposal are shown in tables 2, 3, and 4. Volumes estimated to be discharged at the unconfined, open-water disposal sites under the selected site condition represent about 60 percent of the forecasted volume1/ for the next 15 years in central Puget Sound. This compares well with the historic 36 percent of dredged material volumes from 1970 to 1985 that were actually discharged at the existing Phase I unconfined, open-water sites.

1/Excluding the 3.3 million c.y. of dredging associated with the U.S. Navy Homeport project at Everett, Washington.

TABLE 1a

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON
DISPOSAL OF FUTURE DREDGING VOLUMES
1985-2000

Commencement Bay (CB) and vicinity
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated CB Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Management Condition			
I	3,929	1,348	2,581
II	3,929	3,160	769
III	3,929	3,776	153

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas3/	Volume to Confined Disposal
No Action (PSIC)4/	3,929	225	3,704

1/Estimated volume of future dredged material that could be discharged at the selected sites (once permitted) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria

TABLE 1b

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON
DISPOSAL OF FUTURE DREDGING VOLUMES
1985-2000

Elliott Bay (EB) and vicinity
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated EB Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Management Condition			
I	10,525	3,113	7,412
II	10,525	3,374	7,151
III	10,525	6,162	4,363

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas3/	Volume to Confined Disposal
No Action (PSIC)4/	10,350	1,350	9,175

1/Estimated volume of future dredged material that could be discharged at the selected sites (once permitted) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria

TABLE 1c

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON
DISPOSAL OF FUTURE DREDGING VOLUMES
1985-2000

Port Gardner (PG) and vicinity
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated PG Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Management Condition			
I	4,943	2,212	2,731
II	4,943	4,684	259
III	4,943	4,943	0

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas 3/	Volume to Confined Disposal
No Action (PSIC)4/	4,943	675	4,268

1/Estimated volume of future dredged material that could be discharged at the selected sites (once permitted) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria

TABLE 1d

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON
DISPOSAL OF FUTURE DREDGING VOLUMES
1985-2000

Total Phase I Area
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated Phase I Unconfined Open-Water Disposal Sites1/	Volume to Confined Disposal2/
Site Management Condition			
I	19,397	6,673	12,724
II	19,397	11,218	8,179
III	19,397	14,881	4,516

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas3/	Volume to Confined Disposal
No Action (PSIC)4/	19,397	2,250	17,147

1/Estimated volume of future dredged material that could be discharged at the selected sites (once permitted) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria

TABLE 2

SUMMARY OF
TESTING, DREDGING AND DISPOSAL, COMPLIANCE INSPECTION
AND MONITORING COSTS FOR THE
ALTERNATIVE SITE MANAGEMENT CONDITIONS
1985-2000 1/
($1,000)

Alternative	Testing	Dredging and Disposal	Compliance Inspection	Monitoring	Total
Condition I	$7,179	$259,001	$787	$712	$267,679
Condition II	6,993	194,266	1,324	1,475	204,058
Condition III	5,810	139,492	1,756	3,014	150,072
No Action (PSIC)	6,834	323,553	375	0	330,762

1/Assumptions and derivation of these costs are provided in EPTA and summarized in section 4 of this FEIS.

TABLE 5

COSTS FOR TESTING, DREDGING AND DISPOSAL,
COMPLIANCE INSPECTIONS AND MONITORING OF DREDGED MATERIAL
FOR EACH DISPOSAL SITE
1985-2000 1/
($1,000)

Alternative	Port Gardner	Elliott Bay	Commencement Bay	Phase 1 Area
Site Condition I	$53,930	$165,405	$48,344	$267,679
Site Condition II	19,104	161,556	23,398	204,058
Site Condition III	16,029	118,578	15,465	150,072
No Action (PSIC)	76,194	190,472	64,096	330,762

1/Assumptions and derivation of these costs are provided in FPIA.

TABLE 4

SUMMARY OF TOTAL COSTS PER CUBIC YARD
FOR EACH DREDGING AREA
1985-2000
($1,000) 1/

Alternative	Port Gardner	Elliott Bay	Commencement Bay
Site Condition I			
Unconfined	$3.50	$5.50	$3.60
Confined	17.20	19.90	17.00
Site Condition II			
Unconfined	3.30	5.30	3.40
Confined	17.30	20.00	17.00
Site Condition III			
Unconfined	3.30	5.30	3.40
Confined	17.10	19.80	16.90
No Action (PSIC)			
Unconfined	4.60	6.50	4.70
Confined	17.20	19.80	16.90

1/Derivation of unit costs, rounded to nearest $.10, is based on cost data contained in EPTA. In addition to those assumptions listed in EPTA, to derive costs per cubic yard it was assumed that unconfined, open-water disposal would be the initial preference for all projects. This resulted in allocating the majority of testing costs (e.g., sampling and chemical testing) shown in EPTA to the unconfined option; only "land biological testing" was allocated to confined disposal. All compliance and monitoring costs were allocated to unconfined, open-water disposal.

Mitigation Measures and Their Effectiveness. The selected sites have been located to avoid significant adverse effects (per NEPA) while meeting the in-water disposal needs of Puget Sound dredging. Site location and site management provisions are expected to mitigate any potential biological resource and human use conflict problems. In maintaining the chosen site condition, only acceptable dredged material will be discharged into the Phase I area disposal sites. Environmental monitoring of the disposal sites will allow for verification of anticipated conditions and provide a basis for site management changes if the monitoring demonstrates changes are needed.

The primary mitigation feature of the PSDDA plan is embodied in the siting process. The selected sites are located away from shorelines, resources, and other amenities to preserve and maintain these resources by avoiding adverse effects due to dredged material disposal. Where complete avoidance of all resources was not possible (e.g., benthic invertebrates), the sites were located to minimize possible adverse effects. A minimum number of sites were identified to minimize the possible extent of bottom impacts throughout the central Puget Sound. Additionally, the sites are located in relatively nondispersive areas to minimize the risk of effects extending beyond the disposal sites (including the dilution zone) via sediment transport.

The selected regional, effects-based disposal site management condition precludes the discharge of dredged material that could produce unacceptable adverse effects. Chemical effects on biological resources at the unconfined, open-water disposal sites would be limited. The site condition will ensure that there is no acute toxicity to sensitive species onsite. The selected management condition fully complies with the applicable provisions of the State Water Quality Standards.

Another important mitigation feature of the plan is the environmental monitoring that will be performed at each disposal site. Also, compliance inspections by the PSDDA regulatory agencies will help ensure that the site management condition is not exceeded. The environmental monitoring will provide verification of anticipated site conditions.

Implementation. The Corps and EPA will share with the State of Washington responsibility for implementation of the PSDDA management plan for the Phase I area. DNR and Ecology, as well as Pierce County and the cities of Seattle and Everett, will perform the non-Federal functions. DNR will obtain shoreline management permits from the county and the cities for the selected sites. Responsibility will be shared by DNR with the Corps for site management, with DNR generally performing chemical and biological environmental monitoring. In addition to generally being responsible for physical monitoring of the disposal sites the Corps will develop and maintain a dredged material data management system for Puget Sound that is intended to meet the needs of all the PSDDA agencies.

Responsibilities of each of the PSDDA regulatory agencies under Section 404 or Section 401 of the CWA will be accomplished in accordance with each agency's authorities and policies. The PSDDA dredged material evaluation procedures

will be applied by each regulatory agency consistent with these authorities and policies. The procedures provide the basis for an overall approach which can meet the case-by-case requirements of both Section 404 and Section 401. Most elements of the PSDDA procedures are common to both authorities. However, some elements are unique to either Section 404 or Section 401 requirements. Those seeking approval for unconfined, open-water disposal will need to meet both requirements, i.e., undertake the full suite of PSDDA tests, as each agency determines is applicable.

The Corps requirements for the evaluation of dredged material proposed for unconfined disposal in Puget Sound waters, as specified in Subpart G of the Section 404(b)(1) Guidelines, will be met primarily by the Section 404 components of the PSDDA evaluation procedures. The Section 404 component of the PSDDA procedures are, and will be, applied consistent with the national Corps process. The Corps will address other aspects of the Section 404(b)(1) compliance, such as impacts on navigation and national commerce and avoidance and minimization of impacts, including mitigation of unavoidable impacts and alternatives analysis on a case-by-case basis. Required national Corps procedures for implementation are reflected in 51 FR 19694 dated May 30, 1986 for Corps projects and 33 CFR 320-330 for the Corps regulatory program.

EPA will rely on the PSDDA evaluation procedures as the basis for preventing significant degradation of the aquatic environment, as required by Section 404(b)(1) Guidelines. These procedures represent the testing approaches and procedures, allowed under the guidelines, which EPA would require during the evaluation of dredged material. Other aspects of the Section 404(b)(1) compliance, such as avoidance and minimization of impacts, including mitigation of unavoidable impacts, will also be addressed by EPA, during comprehensive reviews, on a case-by-case basis.

Ecology will apply the appropriate PSDDA evaluation procedures in assessing applications for Section 401 Water Quality Certification. Initially, the procedures will be treated as guidelines. However, depending on actions that might be taken by the Puget Sound Water Quality Authority in their adoption of the PSDDA management plan as a feature of the PSWQA Water Quality Management Plan, the PSDDA evaluation procedures may later be adopted as a State regulation.

Implementation of PSDDA evaluation procedures could begin during the fall of 1988 after the Federal Record of Decision has been completed and the shoreline permits obtained from the local jurisdictions. The selected disposal sites are expected to be available for use by the fall of 1988, after the approval of shoreline permits by local governments (Seattle, Everett, and Pierce County) and Ecology.

Advance identification of the PSDDA disposal sites is being accomplished by EPA and the Corps under subpart I of the Section 404(b)(1) Guidelines (40 CFR 230.80). Under this action a determination has been made that the selected Phase I disposal sites for future disposal of dredged material. This FEIS contains the final determination of suitability in exhibit B.

Details of PSDDA implementation are provided in chapter 9 of the Management Plan Report (MPR).

Review and Revisions. The PSDDA agencies recognize that the state-of-the-art of dredged material testing and test interpretation is rapidly changing. Accordingly, provision is made in the management plan for annual assessments of the data obtained through the regulatory actions on specific dredging projects, as well as the information gained from environmental monitoring of the disposal sites after they have been in use. These assessments will be conducted by the PSDDA agencies with opportunities provided for participation by other interested agencies, organizations, and private citizens. The assessments will provide the basis for appropriate revisions to the PSDDA management plan. Sediment evaluation procedures, site environmental monitoring, and cost aspects of the plan will be reexamined. One result may be a reduction in the level of testing and monitoring, if that is possible without compromising the environmental mandate of the CWA and applicable State authorities. However, only the disposal site location and/or site management condition are presently viewed by the PSDDA agencies as the key alternatives for purposes of NEPA/SEPA compliance. Any change to these elements of the management plan has the potential for significant effects on the environment and may require preparation of a supplemental EIS to this document, should future changes be proposed. The other elements of the management plan, e.g., dredged material evaluation procedures, environmental monitoring, etc., are solely intended to be the means by which the site management condition is controlled. Accordingly, any changes to these other elements are not anticipated to require preparation of a supplemental EIS.

Areas of Controversy and Unresolved Issues. Public controversy concerning disposal site locations and lack of consistent site management among regional regulatory agencies was instrumental in initiating PSDDA. The PSDDA study resolved siting concerns by conducting an intensive disposal site selection process with disposal activities relocated to more suitable areas. The study addressed site management concerns by developing site-specific management plans, including a biological effects condition for each of the Phase I sites.

There are no known unresolved issues concerning the PSDDA disposal sites and site management condition.

Relationship to Environmental Protection Statutes and Other Environmental Requirements. The selected disposal sites, along with the chosen site management condition, fully comply with pertinent Federal, State, and local environmental statutes and requirements. Table 5 summarizes and documents this compliance.

Study Documents. The primary PSDDA study documents include a report containing the management plan, three technical appendixes which provide detailed information in support of the plan and this FEIS covering the alternative disposal sites and site management conditions considered for the Phase I area.

o Management Plan Report (MPR) - Unconfined Open-Water Disposal of Dredged Material Phase I (Central Puget Sound). This document describes the study authorities, background, goal, objectives and planning process which resulted in the PSDDA management plan. The plan is presented with expanded coverage given to major program elements. Also included is a discussion on the implementation of the management plan.

o Disposal Site Selection Technical Appendix (DSSTA). A detailed description of the disposal site selection process for future dredged material disposal is provided along with information on the existing disposal site and alternative sites considered.

o Evaluation Procedures Technical Appendix (EPTA). This appendix covers the dredged material sampling, testing, and disposal guidelines developed by the PSDDA process.

o Management Plans Technical Appendix (MPTA). Dredging and dredged material disposal permit compliance inspection requirements, environmental monitoring of disposal sites, and other site management activities are addressed here.

o Final Environmental Impact Statement (NEPA/SEPA) - Unconfined Open-Water Disposal Sites for Dredged Material, Phase I (Central Puget Sound). This document presents and evaluates the selected Phase I area unconfined, open-water disposal sites and alternative sites considered. Also presented and evaluated for site management are the selected and alternative biological effects conditions. Comments received on the Phase I draft EIS and other supporting draft documents during the 45-days of formal public review (January 15 to March 1, 1988) are presented in exhibit C of the FEIS, together with responses by the PSDDA agencies.

TABLE 5

RELATIONSHIP OF SELECTED ALTERNATIVES TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS, SELECTED UNCONFINED, OPEN-WATER DISPOSAL SITES FOR DREDGED MATERIAL, PHASE I (CENTRAL PUGET SOUND), PUGET SOUND DREDGED DISPOSAL ANALYSIS

NOTES: The compliance categories used in this table were assigned based on the following definitions:

a. Full Compliance - All the requirements of the statute, executive order, and related regulations have been met.

b. Partial Compliance - Some requirements of the statute, executive order, or other policy and related regulations remain to be met (see footnotes).

c. Noncompliance - None of the requirements of the statute, executive order, or other policy and related regulations have been met.

d. *Not Applicable* (N/A) - Statute, executive order, or other policy not applicable.

e. Most of the statutes and policies are fully applicable to, and must be addressed separately for, future individual dredging projects.

ENVIRONMENTAL STATUTES	No Action	Commencement Bay Site 1 Condition II	Elliott Bay Site 1 Condition II	Port Gardner Site 1 Condition II
Federal Statutes				
American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.	Full	Full	Full	Full
Archeological and Historic Preservation Act of 1974, 16 U.S.C. 469 et seq., Public Law 93-291.	Full	Full	Full	Full
Clean Air Act, as amended, 42 U.S.C. 7401 et seq.	Full	Full	Full	Full

TABLE 5 (con.)

ENVIRONMENTAL STATUTES	No Action	Commencement Bay Site 1 Condition II	Elliott Bay Site 1 Condition II	Port Gardner Site 1 Condition II
Federal Statutes (con.)				
Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.	Full	Partial 1/	Partial 1/	Partial 1/
Deepwater Port Act of 1974, as amended, 33 U.S.C. 1501 et seq.	Full	Full	Full	Full
Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq., Public Law 97-304.	Full	Full	Full	Full
Estuary Protection Act, 16 U.S.C. 1221 et seq.	Full	Full	Full	Full
Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977, 33 U.S.C 1251 et seq.	Full	Full	Full	Full
Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.	Full	Full	Full	Full
Fish and Wildlife Coordination Act of 1956, as amended, 16 U.S.C. 661 et seq.	Full	Full	Full	Full
Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 460d, 4601-4604 et seq.	Full	Full	Full	Full

1/Full compliance with receipt of disposal site shoreline permits by DNR.

TABLE 5 (con.)

ENVIRONMENTAL STATUTES	No Action	Commencement Bay Site 1 Condition II	Elliott Bay Site 1 Condition II	Port Gardner Site 1 Condition II
Federal Statutes (con.)				
Marine Mammal Protection Act of 1972, as amended, 16 U.S.C. 1361 et seq.	Full	Full	Full	Full
Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 et seq.	N/A	N/A	N/A	N/A
National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 et seq.*	Full	Partial 1/	Partial 1/	Partial 1/
National Historic Preservation Act of 1966, Public Law 89-665, 16 U.S.C. 470 et seq., as amended by Public Law 96-515, December 12, 1980.	Full	Partial 2/	Partial 2/	Partial 2/
Rivers and Harbors Appropriations Act of 1899, 33 U.S.C. 401 et seq.	Full	Full	Full	Full
Watershed Protection and Flood Prevention Act, as amended 16 U.S.C., 1001, et seq.	N/A	N/A	N/A	N/A
Wild and Scenic Rivers Act of 1968, as amended, 16 U.S.C. 1271 et seq.	N/A	N/A	N/A	N/A

1/Full compliance with completion of the Federal Record of Decision.
2/Full compliance with completion of ongoing investigations of potentially historic shipwrecks located at the Elliott Bay disposal site.

TABLE 5 (con.)

ENVIRONMENTAL STATUTES	No Action	Commencement Bay Site 1 Condition II	Elliott Bay Site 1 Condition II	"ort Gardner Site 1 Condition II
Executive Orders and Regulations				
Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementations Studies, 48 CFR 10249-10258, 10 March 1983.	N/A	N/A	N/A	N/A
Environmental Effects Abroad of Major Federal Actions EO 12114.	N/A	N/A	N/A	N/A
Floodplain Management, EO 11988, 24 May 1977.	Full	Full	Full	Full
Navigable Waters, Discharge of Dredged or Fill Material, 40 CFR 230. Environmental Protection Agency.	Full	Full	Full	Full
Protection of Wetlands, EO 11990.	Full	Full	Full	Full
Regulatory Programs of the Corps of Engineers. 33 CFR 320-330, 22 July 1982.	N/A 1/	N/A 1/	N/A 1/	N/A 1/
Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act of 1969, 40 CFR 1500-1508, 29 November 1978. Council on Environmental Quality.	Full	Partial 2/	Partial 2/	Partial 2/

1/Permits required for future, individual dredging projects.
2/Full compliance with completion of the Federal Record of Decision.

TABLE 5 (con.)

ENVIRONMENTAL STATUTES	No Action	Commencement Bay Site 1 Condition II	Elliott Bay Site 1 Condition II	Port Gardner Site 1 Condition II
State and Local Policies				
Multiple Use Concept in Management and Administration of State Owned Lands (RCW 79.68.060).	Full	Full	Full	Full
State Environmental Policy Act of 1971 (RCW 43.21).	Full	Full	Full	Full
Water Resources Act of 1971 (RCW 90.54).	Full	Full	Full	Full
Shoreline Management Act of 1971 (RCW 90.58) and related Shoreline Master Programs.	Full	Partial 1/	Partial 1/	Partial 1/
Water Pollution Control Act (RCW 90.48).	Full	Full	Full	Full
Puget Sound Water Quality Authority Comprehensive Plan	Full	Full	Full	Full
Washington Department of Natural Resources Disposal Site Management Policy (WAC 332-30-166)	Full 2/	Partial 1/	Partial 1/	Partial 1/

1/Full compliance with receipt of disposal site shoreline permits by DNR.
2/Permits required for future individual dredging projects.

TABLE 5 (con.)

ENVIRONMENTAL STATUTES	No Action	Commencement Bay Site 1 Condition II	Elliott Bay Site 1 Condition II	Port Gardner Site 1 Condition II
State and Local Policies (con.)				
- Washington Department of Ecology Water Quality Certification	N/A 1/	N/A 1/	N/A 1/	N/A 1/
Land Use Plans				
City of Seattle Shoreline Master Program	Full	Partial 2/	Partial 2/	Partial 2/
City of Everett Shoreline Master Program	Full	Partial 2/	Partial 2/	Partial 2/
Pierce County Shoreline Master Program	Full	Partial 2/	Partial 2/	Partial 2/

1/Permits required for future individual dredging projects.
2/Full compliance with issuance of disposal site shoreline permits to DNR.

UNCONFINED, OPEN-WATER DISPOSAL SITES FOR DREDGED MATERIAL
PHASE I AREA, CENTRAL PUGET SOUND
PUGET SOUND DREDGED DISPOSAL ANALYSIS
PHASE I AREA
FINAL ENVIRONMENTAL IMPACT STATEMENT

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SECTION 1. PURPOSE AND NEED FOR ACTION

1.01 General. This final environmental impact statement (FEIS) presents the alternatives considered in identifying the public multiuser confined, open-water sites selected for the disposal of dredged material in the Phase I area of the Puget Sound Dredged Disposal Analysis (PSDDA) study. This study is being conducted by the U.S. Army Corps of Engineers, Seattle District (Corps); the Environmental Protection Agency, Region X (EPA); and Washington Departments of Natural Resources (DNR) and Ecology (Ecology).

The recognized need for dredging and dredged material disposal in Puget Sound and the following conditions led to the PSDDA study:

o Two of the three existing central Puget Sound disposal sites were closed when the study began due in part to public concerns over site management. While one of the sites reopened for 1 year it closed again in June 1987. All three of the sites are now closed due to the expiration of the local shoreline permits issued to DNR for these sites.

o There were agency and public concerns with regard to proper disposal site locations. Objections were raised about the proximity of the existing Port Gardner and Fourmile Rock disposal sites to residential and public recreations use areas.

o The lack of fully consistent evaluation procedures, or specific objective decision criteria led, in part, to the establishment of interim disposal criteria by EPA and Ecology for the Fourmile Rock disposal site in Seattle's Elliott Bay in 1984 and the Port Gardner site near Everett in 1985. The Fourmile Rock Interim Criteria (FRIC) became a condition of the local shoreline permit issued by the city of Seattle to DNR, and the Port Gardner interim criteria a condition of the city of Everett permit for the existing Port Gardner site. Subsequently, in 1985, Ecology developed the Puget Sound Interim Criteria (PSIC) to ensure that the other Puget Sound disposal sites remained permitted by local authorities. These criteria have been used as interim criteria pending development of regional Sound-wide guidelines for dredged material disposal.

o There were no disposal site management plans nor overall disposal site management policy, either Federal or State. Few permit compliance inspections had been performed and no environmental monitoring conducted of site conditions due to inadequate funding. The lack of monitoring contributed to public concerns about the discharge of dredged materials. Without monitoring data it was impossible to fully assess disposal effects.

In August 1984, the Regional Administrator for EPA asked the Corps to lead a Sound-wide study on dredged material disposal that would produce a programmatic EIS. The request was supported by the Washington State Governor, members of the State Congressional Delegation, the Director of Ecology, the Commissioner of Public Lands for DNR, and many others, including the Puget

Sound Water Quality Authority (PSWQA), by letters and personal contacts. In December 1985, the Corps, EPA, Ecology, and DNR began a period of intensive technical discussions to develop a joint study plan. The culmination of these efforts was the PSDDA Plan of Study, agreed to by the agencies in March 1985, which established the basis for the cooperative effort. The PSDDA study was initiated in April 1985.

This FEIS details the alternatives for, and environmental consequences of, the disposal of acceptable dredged material at PSDDA-identified, unconfined, open-water sites in central Puget Sound pursuant to the National and State Environmental Policy Acts (NEPA and SEPA, respectively). The FEIS presents the results of studies for the Phase I area of PSDDA. This area encompasses the central basin of Puget Sound, which includes the major urban embayments of Seattle, Tacoma, and Everett. The Phase II area (the balance of the Puget Sound region) will be the subject of a separate environmental impact statement (EIS).

The PSDDA FEIS does not address the dredging and disposal aspects of specific projects or disposal options in detail, other than unconfined, open-water disposal. These will be assessed in project documents prepared by each dredger.

The reader is referred to the Management Plan Report (MPR), accompanying this FEIS, for a full discussion of the Phase I area dredged material management plan. The MPR identifies the selected unconfined, open-water disposal sites, evaluation procedures for dredged material that will be analyzed for disposal at these sites, and site management considerations including environmental monitoring.

1.02 Issues and Concerns.

a. Dredging and Disposal in Puget Sound. Throughout the 2,500 square miles of water area in Puget Sound, there are 34 port districts serving the region, 54 miles of Federal navigation channels, 52 miles of port terminal ship berths along these channels, and more than 200 small boat harbors that must be periodically dredged to maintain the commercial and recreational services provided by these facilities. The Federal navigation channels occupy about 1.5 square miles (0.06 percent of Sound's water surface), though only about 0.02 square miles (0.0008 percent of the Sound) are dredged annually.

Dredging and disposal of dredged material has been a common and longstanding practice in Puget Sound waters, typically associated with the development of waterborne commerce and recreational boating. In addition to new port and harbor construction, maintenance dredging to ensure safe water depths in existing shipping channels and dock areas produces large volumes of dredged material. Historically, much of this material was deposited along the shoreline to produce new land. However, a significant portion is increasingly being placed in the Sound due to the limited availability and high costs of acceptable land or nearshore disposal sites.

The trend toward increased open-water disposal of dredged materials can be seen in volume statistics for Corps' projects in the 15 years between 1970 and 1985. Only 26 percent of the Corps' dredged material went to open-water sites in the 1970's, as most of the material could be more economically placed in upland or nearshore disposal areas located near the dredging projects. Very little of the material was considered unacceptable for unconfined, open-water disposal. Since 1980, over double this percentage (56 percent) has been going to open-water sites because less economical alternatives have not been available. This trend is expected to continue in the future as land and shore disposal areas become more scarce due to environmental and human use conflicts, or prohibitively expensive due to transport distance and design requirements.

Projections for the next 15 years indicate that more dredging activity will occur in central Puget Sound than during the past 15 years. The forecasted total volume to be dredged between 1985 and 2000 is 22,697,000 cubic yards, or about 35 percent more than the total dredged during the previous 15 years. Both Federal projects and permit applications point toward a continued and increasing demand for unconfined, open-water disposal sites.

b. Problem Sediments and Public Concerns. The location of existing disposal sites and the acceptability of dredged material discharged at these sites has been questioned by scientists, local governments, citizens, and resource agencies.

Measurable levels of some chemicals of concern are found in all Puget Sound sediments; however, relatively high concentrations of potentially harmful chemicals have been noted in urban and industrialized waterways where tumors and other biological abnormalities are found with a greater than normal frequency in certain fish and shellfish. Recent data indicate that chemicals, which enter the Sound from a variety of point and nonpoint sources, bind to particles and settle to the bottom. This has caused the public and the agencies to be concerned about potential impacts associated with the disposal of sediments dredged from these waterways. Several Federal and State agency programs have recently targeted the reduction of chemical discharges into the Sound. Over the longer term, these programs are expected to result in improved conditions in the waterway sediments.

While many of the effects of dredged material disposal have been studied and are well understood (Saucier, et al., 1980), information to address the long-term consequences (chronic effects) of contaminated sediments has been less intensive. As a result, public pressure has been exerted to severely restrict or prohibit dredged material disposal in Puget Sound, even leading to closures of key open-water disposal sites near the major dredging areas of Seattle and Everett. Such closures have delayed maintenance dredging of shipping harbors and channels and increased the cost of harbor improvement projects. Consequently, disposal of dredged sediments removed from waterways for channel maintenance or for new port construction has become a major management problem.

PSDDA has addressed this problem by identifying new sites based on detailed site identification studies, and by specifying a limiting biological effects condition for use in site management.

c. Regulatory Consistency and Predictability. Not all dredged materials contain the same concentrations of chemicals, or even the same chemicals. Large volumes of dredged sediments in Puget Sound have acceptable chemical levels, and are suitable for open-water disposal. In addition, the availability of the sediment chemicals for uptake by aquatic organisms (bioavailability) varies between different sediments. Thus, the responses to handling dredged materials must be on a somewhat case-by-case basis. However, consistency among the various regulatory agencies overseeing dredged material disposal and a predictability in permitting and administration of sites is needed in order to meet environmental goals as cost-effectively as possible. Predictability and consistency are also important to the private sector where investment risk assessment is often critical, and the governmental approval process is viewed with concern.

Though the PSIC are recognized as a useful interim solution, a number of concerns have been expressed over use of the criteria. By basing the interim criteria only on comparison to reference, the potential for sediment chemicals to cause adverse effects to biological resources has not been directly considered. As a result, when a relatively pristine area is used as a reference the criteria overly restrict dredged material disposal and result in unnecessary costs. When previously used disposal sites are taken as the reference areas there is concern that an existing adverse situation might be allowed to persist.

1.03 Goal and Objectives. The goal of PSDDA is to provide publicly acceptable guidelines governing environmentally safe, unconfined open-water disposal of dredged material in Puget Sound, improving consistency and predictability in the site management process. Public acceptability includes consideration of a wide range of factors. Among these are scientifically sound procedures and practicability, which includes cost effectiveness, and the extent and permanence of beneficial and/or detrimental effects. This goal is in consonance with Section 404 of the Federal Clean Water Act (CWA) and the Section 404(b)(1) Guidelines (40 CFR Part 230), whose purpose is to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material.

The major study issues addressed in the FEIS are:

o the identification of acceptable unconfined, open-water disposal sites and

o the determination of a limiting biological effects condition for disposal site management.

1.04 Relation of Study to Federal and State Authorities. The specific authorities by which the Corps, EPA, DNR, and Ecology are participating in the

PSDDA study and which will govern their actions during implementation of the management plan are briefly described here. A more detailed discussion is contained in the MPR.

a. Federal Authorities. The Corps regulatory authority over waters of the United States includes disposal of dredged materials in navigable waters such as Puget Sound. The Corps authority to issue or deny permit applications stems from Section 404 of the CWA (Public Law 92-500, as amended). Section 404 authorizes the Secretary of the Army, acting through the Corps, to issue permits for the discharge of dredged or fill material into waters of the United States. These permits specify disposal sites for dredged material determined to be suitable for discharge into waters of the United States in accordance with the Section 404(b)(1) Guidelines (discussed below). Section 404(b)(2) allows the Corps to issue permits otherwise prohibited by the Guidelines, based on consideration of the economics of anchorage and navigation. The public interest review process used by the Corps provides for consideration of a number of factors in permit and project decisions. Permit decisions will be based on an evaluation of probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest (33 CFR 320.4). Via this weighing and balancing process, a permit decision is influenced by broad considerations. For activities involving 404 discharges, a permit will be denied if the discharge that would be authorized by such a permit would not comply with the 404(b)(1) Guidelines (subject to the 404(b)(2) exception).

EPA, in conjunction with the Corps, develops guidelines for the specification and use of disposal sites under Section 404(b)(1) of the CWA. EPA is authorized by Secton 404(c), after notice and opportunity for public hearings, to prohibit or restrict the use of a disposal site whenever it determines that the discharge of such materials will have "unacceptable adverse impacts" on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas. Further, the State of Washington is authorized by Section 401 of the CWA to make determinations regarding a water quality certification prior to issuance of a Federal permit for, or conduct of a Federal project involving, dredged material disposal in waters of the United States.

The overall guidelines for specification of disposal sites for dredged material are the Section 404(b)(1) Guidelines (40 CFR Part 230). These guidelines require consideration of numerous factors prior to allowing disposal of dredged material in waters of the United States. Subpart G of the Section 404(b)(1) Guidelines provides guidance for evaluation and testing of dredged material to be disposed into waters of the United States. Per the Guidelines, specific evaluation procedures are furnished by the Corps and EPA as "interim guidance" (40 CFR 230.61). In 1980, EPA, in conjunction with the Corps published final Guidelines for the specification of disposal sites for dredged or fill material. These specify that the disposal of dredged material must not result in an "unacceptable adverse impact" to aquatic ecosystems. Simultaneously, proposed rules for testing requirements were published. Although final rulemaking has not taken place, the testing requirements and procedures have been implemented by the Corps as a matter of policy.

Advance identification of the PSDDA disposal sites was accomplished concurrent with public review of the Phase I draft documents by EPA and the Corps under subpart I of the Section 404(b)(1) Guidelines (40 CFR 230.80). Under this action a determination was made of the suitability of the selected Phase I disposal sites for future disposal of dredged material. This FEIS contains the notice of final determination of suitability (see exhibit B).

The National Environmental Policy Act (NEPA) requires all Federal agencies to assess the environmental impacts of major Federal actions significantly affecting the quality of the human environment and to consider all reasonable alternatives (see paragraph 1.04.3 below). The Coastal Zone Management Act (CZMA) (Public Law 92-583) requires that Federal projects be consistent to the maximum extent practicable, with the State's coastal zone management program (CZMP). For non-Federal projects, consistency requirements are more rigorous.

b. State Authorities. Congress granted to the states the responsibility for certifying under Section 401 of the CWA that a proposed discharge, resulting from a project described in a Corps public notice issued under Section 404 of the CWA, will comply with all applicable provisions of State and Federal water quality laws. Ecology has interpreted these laws to include sediment quality as an aspect of water quality. This certification is required from any applicant for a Federal permit (or Federal project) to conduct any activity which may result in any discharge into State waters. Compliance with Section 401 also ensures that any such discharge will comply with the applicable provisions of Sections 301, 302, 303, 306, and 307 of the CWA. In particular, Section 303 allows states to establish water quality standards and provides that discharges meet these standards.

Ecology also establishes guidelines for State and local administration of the Washington Shoreline Management Act (SMA) (RCW 90.58). Ecology ensures that permits issued by local governments are consistent with the intent of the act.

DNR is the State proprietary land agency that manages State-owned tidelands and bottom lands of Puget Sound, including the disposal sites. DNR designates unconfined, open-water disposal sites, secures local shoreline permits for site use, issues site permits to dredgers (other than the Corps), and manages site use. DNR site designation has been historically accomplished by an interagency siting committee. The Corps participates on this committee and utilizes the State-designated sites for Federal dredging projects.

c. Implementation of the PSDDA Evaluation Procedures. Responsibilities of each of the PSDDA regulatory agencies under Section 404 or Section 401 of the CWA will be accomplished in accordance with each agency's authorities and policies. The PSDDA dredged material evaluation procedures, described in the MPR and the Evaluation Procedures Technical Appendix (EPTA), will be applied by each regulatory agency consistent with these authorities and policies. The procedures provide the basis for an overall approach which can meet the case-by-case requirements of both Section 404 and Section 401. Most elements of the PSDDA procedures are common to both authorities. However, some elements are unique to either Section 404 or Section 401 requirements. Those seeking

approval for unconfined, open-water disposal will need to meet both requirements, i.e., undertake the full suite of PSDDA tests, as each agency determines is applicable.

The Corps requirements for the evaluation of dredged material proposed for unconfined disposal is Puget Sound waters, as specified in Subpart G of the Section 404(b)(1) Guidelines, will be met primarily by the Section 404 components of the PSDDA evaluation procedures. The Section 404 component of the PSDDA procedures are, and will be, applied consistent with the national Corps procedures. The Corps will address other aspects of the Section 404(b)(1) compliance, such as impacts on navigation and national commerce and avoidance and minimization of impacts, including mitigation of unavoidable impacts and alternatives analysis on a case-by-case basis. Required national Corps procedures for implementation are reflected in 51 FR 19694 dated May 30, 1986 for Corps projects and 33 CFR 320-330 for the Corps regulatory program.

The EPA will rely on the PSDDA evaluation procedures as the basis for preventing sediment degradation of the aquatic environment, as required by Section 404(b)(1) Guidelines. These procedures represent the testing approaches and procedures, allowed under the guidelines, which EPA would require during the evaluation of dredged material. Other aspects of the Section 404(b)(1) compliance, such as avoidance and minimization of impacts, including mitigation of unavoidable impacts, will also be addressed by EPA, during comprehensive reviews, on a case-by-case basis.

Ecology will apply the appropriate PSDDA evaluation procedures in assessing applications for Section 401 Water Quality Ceritification. Initially, the procedures will be treated as guidelines. However, the PSDDA evaluation procedures may later be adopted as a State regulation, depending on actions that might be taken by the Puget Sound Water Quality Authority in their adoption of the proposed PSDDA management plan as a feature of the PSWQA Water Quality Management Plan.

The State Environmental Policy Act (SEPA) (RCW 43.21c) requires consideration of environmental impacts in taking "actions" as defined by the regulations. Adoption of the PSDDA program is considered to be a nonproject action and is subject to SEPA (see paragraph 1.04.c below).

d. NEPA and SEPA Requirements. Both NEPA and SEPA call for the integration of environmental considerations into the planning process concurrent with the evaluation of economic, social, and technological aspects of a proposal or plan. The procedural requirements of these laws specify the documentation and disclosure of this integrated assessment when recommending or proposing an agency action (unless such action is of minor consequence to the environment and is categorically excluded from this assessment). The extent of the documentation is dependent on the degree of potential adverse environmental effects resulting from the proposal. Per NEPA, an EIS is required "in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment" (40 CFR 1502.3). The term "significantly" requires consideration of both "context"

(affected region, affected interests, and locality) and "intensity" (degree, controversy, persistence, geographic extent, etc., of effects) (40 CFR 1508.27). EIS's may be needed for specific project proposals, or may be prepared for broad Federal actions (such as the adoption of programs that affect larger geographic areas (i.e., a large water body such as Puget Sound), or that generically involve many similar actions (40 CFR 1502.4)). The SEPA requirements are very similar to those of NEPA. Pursuant to SEPA, an EIS is required once a responsible official has determined that a proposal may have "probable significant adverse environmental impact" (WAC 197-11-360). However, EIS's may be prepared for other purposes, as was done in the case of PSDDA.

NEPA includes "planning to avoid and minimize adverse effects" as one aspect of "mitigation." The PSDDA plan avoids and minimizes potential adverse effects. Consequently, the plan elements are, in part, a mitigation feature of dredged material management. The goal of environmental protection and the objectives of the CWA have been met by the plan. Under both NEPA and SEPA, mitigation that reduces the probable adverse impact to less than significant levels can be a basis for deciding that an EIS is not warranted (as long as the mitigation is an integral part of the original proposal), though NEPA rules discourage this approach.

The decision to prepare an EIS as part of the PSDDA study was not based on an a priori determination that the resulting adverse effects would be "significant." It was recognized that the environmental impacts of the plan will depend on where disposal sites are located and the dredged material that will be discharged at those sites. Accordingly, the agencies participating in the PSDDA study agreed to prepare an EIS to "encourage and facilitate public involvement in decisions which affect the quality of the human environment" (40 CFR 1500.2) (emphasis added). The March 1985 PSDDA plan of study notes that the EIS will provide a "a formal and accepted means to involve the public" and "the basis for subsequent implementing actions" by the PSDDA agencies.

1.05 Relationship to Other Documents. The PSDDA Phase I FEIS provides an assessment of probable impacts resulting from the selected alternatives. The FEIS systematically presents alternative unconfined, open-water siting options and alternative disposal site management conditions. Options not deemed feasible or environmentally appropriate are identified and then dropped from final consideration. Information used in the selection of unconfined, open-water disposal sites, and the biological effects condition for site management is displayed.

Only the disposal site location and/or site management condition are viewed as the key alternatives for purposes of NEPA/SEPA compliance. Any change to these elements of the management plan has the potential for significant effects on the environment and may require preparation of a supplemental EIS, should future changes be proposed. The other elements of the management plan, e.g., dredged material evaluation procedures, environmental monitoring, etc., are solely intended to be the means by which the site management condition is controlled. Accordingly, any changes to these other elements are not anticipated to require preparation of a supplemental EIS.

Other PSDDA documents which support this FEIS include a report containing the management plan and three technical appendixes which provide detailed information in support of the plan. These documents are further described below:

o Management Plan Report (MPR) - Unconfined, Open-Water Disposal of Dredged Material, Phase I (Central Puget Sound). This document describes the study authorities, background, goal, objectives, and planning process which resulted in the PSDDA management plan. The plan is presented with expanded coverage given to major program elements. Also included is a discussion on the implementation of the management plan.

o Disposal Site Selection Technical Appendix (DSSTA). A detailed description of the disposal site identification process for future dredged material disposal is provided along with information on the existing disposal sites and alternative sites considered.

o Evaluation Procedures Technical Appendix (EPTA). This appendix covers the dredged material sampling, testing, and disposal guidelines developed during the PSDDA study.

o Management Plans Technical Appendix (MPTA). Dredging and dredged material disposal permit compliance inspection requirements, environmental monitoring of disposal sites, and other site management activities are addressed here.

PSDDA Technical Reports. Bound separately and referenced in the above documents are many technical reports prepared through the PSDDA study. These reports provide the details of the scientific analysis, field studies, and public involvement in support of the PSDDA findings.

Dredged Material Research Program (DMRP) Reports. The PSDDA study has recognized the considerable nationwide research which has been accomplished since the early 1970's through the Corps' Dredged Material Research Program (DMRP). This program has assessed the environmental effects of dredged material disposal (Saucier et al., 1980). As part of the DMRP, studies were conducted in Elliott Bay and elsewhere in Puget Sound. The research has been used by the Corps in making decisions on dredged material disposal. DMRP has shown that most dredged material nationwide is acceptable for open-water disposal and can have many potential beneficial uses, including fish and wildlife habitat development. Puget Sound examples of beneficial uses of dredged material include Jetty Island at Everett, clam habitat development at Oak Bay Canal, and a beach feed erosion control at Keystone Harbor on Whidbey Island. DMRP reports were prepared and published by the Corps Waterways Experiment Station (WES) located in Vicksburg, Mississippi. Research and development continues on all aspects of dredged material disposal through the Corps' Environmental Effects of Dredging Programs, administered by the Corps' WES (Engler et al., 1987).

Puget Sound Water Quality Authority (PSWQA) 1987 Water Quality Management Plan. A final Puget Sound Water Quality Management Plan, adopted by PSWQA in December 1986, proposes various actions to control and prevent pollution Sound-wide. According to legislative mandate, the plan contains recommendations addressing a variety of pollution related issues including nonpoint source pollution management, industrial pretreatment of toxic wastes, dredged material disposal management, and the protection, preservation, and restoration of wetlands, wildlife habitat, and shellfish beds. (For detailed information about comprehensive pollution control efforts, see the 1987 Puget Sound Water Quality Management Plan (PSWQA, January 1987) and the Final Environmental Impact Statement and Revised Preferred Plan (PSQWA, December 1986).

PSDDA is acknowledged by PSWQA as the appropriate effort for dealing with unconfined, open-water disposal of dredged material. The PSDDA Phase I plan may be incorporated in an amended PSWQA water quality management plan. The evaluation of dredging and disposal of dredged material containing contaminated sediments has been addressed in the Puget Sound Water Quality Management Plan. The PSWQA plan calls for Ecology to "develop and adopt by regulation, criteria for identifying and designating sediments that have observable acute or chronic adverse effects on biological resources or pose a significant health risk to humans. Sediments that exceed the criteria are defined as 'sediments having adverse effects.'" However, the plan notes that "these sediment criteria will not necessarily be directly applied to decisions on dredged material disposal or the cleanup of contaminated sediment sites. PSDDA is expected to recommend criteria for environmentally safe and publicly acceptable unconfined aquatic disposal of dredged material that allow some material with adverse effects to be disposed of in open water."

PSDDA Phase II EIS. A separate EIS will be prepared for the Phase II study area. The disposal site selection process may differ somewhat from that used in Phase I because of different environmental conditions. However, the general approach to site identification studies and assessment of alternative site management conditions used for Phase I have been applied to Phase II. Public review of the Phase II DEIS is currently expected to begin during the winter of 1988.

1.06 Study Coordination/Public Involvements. Extensive coordination occurred during the course of the PSDDA Phase I study and many opportunities were provided for public involvement. This is fully described in section 6. Exhibit C contains the comments received on the Phase I draft EIS and other supporting draft documents during the 45-day formal public review (January 15 to March 1, 1988), together with responses by the PSDDA agencies.

SECTION 2. ALTERNATIVES

2.01 Introduction. The alternatives adddressed in this FEIS were formulated to meet the site identification and management objectives of the PSDDA study. The environmental consequences are primarily associated with the location of the disposal sites and the definition of limiting disposal site biological effects conditions that would be used for management. In defining alternative site management conditions, varying degrees of adverse biological effects that might occur at the sites were addressed. Consequently, the final action alternatives analyzed result from combinations of the different site locations and consideration of different biological effects site management conditions.

Many features of site management are common to all action alternatives, and include the necessary activities for proper site control and program administration by the various regulatory agencies. As these features are viewed primarily as implementing or management activities, supporting the disposal sites and site management conditions, they are not addressed as alternatives in the FEIS. Also these supporting elements of the management plan do not differ greatly among sites or site conditions. Common features of site management that are directly pertinent to the environmental consequences of PSDDA are summarized in section 2.05.

While the PSDDA agencies have not addressed other methods of dredged material disposal (i.e., uplands, nearshore, or confined aquatic) as specific alternatives in the FEIS, these other methods are treated on a generic basis and reflected in the impact analysis. In considering what material is acceptable for unconfined, open-water disposal at the newly identified sites, no attempt was made to resolve what should be done with material that would not be found acceptable for unconfined, open-water disposal. There were several reasons for this. First, while disposal in Puget Sound revolves around many regionwide and statewide issues, disposal on land (especially for material containing elevated levels of chemicals of concern) is very much associated with local government decisions regarding land uses. Second, the authorities of the various agencies involved in PSDDA are not easily applied to land. And last, the State of Washington, in a recently initiated study, is addressing confined disposal options and associated testing procedures, building on the work done through PSDDA.

The option for "pretreatment" of dredged material prior to disposal at unconfined, open-water sites was considered. Pretreatment consists of either separating chemicals of concern from dredged material, immobilizing these chemicals in dredged material, or destroying them in dredged material prior to disposal. Separation may be accomplished physically or chemically. Because most chemicals of concern are associated with the fine-grained sediments, physical separation of the fine grained from the coarse-grained fraction of the material will generally separate out the chemicals. However, the technical and economic feasibility of this technique, which would be highly project-specific, has not been attempted in the field. Laboratory research is underway regarding chemical separation with various solvents. However, this

technique also has not been demonstrated in the field. Costs for all separation techniques are substantial. The second technique, immobilization of chemicals of concern (more specifically called solidification/stabilization techniques), has not been attempted in field-scale projects or coupled with unconfined, open-water disposal. More research and development would be needed before chemical immobiliation becomes feasible. The final technique, destruction of chemicals of concern via incinerator followed by residue disposal, is very costly and time consuming, and is not currently economically and logistically feasible. However, there may be some instances in the future where incineration will be feasible for very small volumes of material containing high concentrations of organic compounds. Consequently, the pretreatment option is not recommended for wide application in Puget Sound due to a lack of field-scale testing, uncertain costs, and the unavailability of equipment, and the highly project-specific nature of the chemical pretreatment process.

The development of the final alternatives considered in the FEIS is displayed in table 2.1. The matrix outlines the systematic process used to define feasible alternatives that meet the study objectives. It also serves as a map of the analysis provided in the remainder of section 2, as references to the appropriate paragraphs are provided for each matrix topic. As shown in the table, the final alternatives (combinations of specific unconfined, open-water disposal sites and biological effects site conditions) are individually addressed in sections 3 and 4 of the FEIS. As discussed in paragraph 2.04.c below, the site management condition will be applicable to the entire Phase I area, thereby assuring consistency in dredged material management for central Puget Sound. To emphasize this regional perspective, the environmental consequences of the Phase I preferred site condition are addressed in section 5 of the FEIS.

2.02 No Action Alternative. The regulations established for implementation of the National Environmental Policy Act (NEPA) and the State of Washington Environmental Policy Act (SEPA) require consideration of reasonable alternative actions. The No Action alternative is mandatory in this analysis.

Because PSDDA is dealing with both disposal site identification and the site biological effects condition for the management of unconfined, open-water sites, the No Action alternative is somewhat more complex than for a typical dredging project. As discussed in the following paragraphs, several possible definitions of the No Action alternative were considered. These included "no dredging," "continue past management practices," and "no designation of public multiuser unconfined open-water disposal sites."

a. No Dredging. Under this possible No Action alternative the problem of disposing of dredged material would be handled by precluding dredging projects. With "no dredging," most harbors and waterways that were developed through dredging would eventually experience shoaling to the point that commercial and recreational traffic would be impaired, causing severe socioeconomic hardships to both the private and public sectors. While potentially significant, the foregone benefits (for new projects) and economic impacts

TABLE 2.1

DEVELOPMENT OF DEIS ALTERNATIVES AND PHASE I AREA SITE MANAGEMENT CONDITIONS

Disposal Philosophy (Section 2.03.b)	General Siting Locations (Section 2.03.c)	Number of Sites (Section 2.03.d)	Zones of Siting Feasibility (Section 2.03.e)	Selection of Disposal Sites (Sections 2.03. i through k)	DEIS Alternatives (Sections 2.05, 3, 4)	Site Condition for Phase I Area (Section 5)
Dispersive	Pacific Ocean	One or Two	Priority 1 ZSF's	Commencement Bay	Commencement Bay	
Nondispersive	Central Puget Sound	Four or More	Priority 2 ZSF's	CB1	CB1-I	
	Strait of Juan de Fuca	Three		CB2	CB1-II*	
				Elliott Bay	CB2-II	
				EB1	CB1-III	
				EB2	Elliott Bay	Site Condition II, All Sites*
				Port Gardner	EB1-I	
				PG1	EB1-II*	
				PG2	EB2-II	
				PG3 (Saratoga)	EB1-III	
					Port Gardner	
					PG1-I	
					PG1-II*	
					PG2-II	
					PG3-II	
					PG1-III	

*Preferred Alternatives

SITE MANAGEMENT CONDITIONS

Biological Effects Conditions (Section 2.03.c)	Single vs. Multiple Site Conditions (Section 2.03.d)
Site Condition Ø	
Site Condition I	Same Site Condition All Sites
Site Condition II	Multiple Site Conditions
Site Condition III	
Site Condition IV	
Site Condition V	

(for maintenance projects) of not dredging are dependent on project-specific factors. With available information, it is not possible to quantify the effects of discontinuing dredging in the Phase I area. However, the potential loss of marine commerce and other related economic activities could result in two significant impacts - social disruption from loss of jobs and loss of property tax revenue. Dredging of existing and future navigation channels and berths is essential to Puget Sound area ports, marinas, and other marine activities. Future Phase I area dredging volumes are estimated to reach about 22.7 million cubic yards (c.y.) over the period 1985-2000, an increase of nearly 35 percent over the previous 15 years.

The "no dredging" alternative is not considered to be a realistic option for central Puget Sound as it does not serve the overall public interest and therefore is not considered to be implementable. Accordingly, this alternative was dropped from further consideration as the appropriate No Action alternative.

b. Continue Past Management Practices. Disposal site designation in the past has been accomplished by DNR in accordance with established regulations (WAC 332-30-166), and with the approval of local shoreline jurisdictions which grant a shoreline permit to DNR. DNR has designated sites near each of the major dredging areas in the Phase I area (Commencement Bay, Elliott Bay, and Port Gardner).

Until 1984, Puget Sound dredged material sampling, testing, and test interpretation requirements were established on a project by project basis. EPA and the Corps, in cooperation with Ecology, assessed non-Corps dredging projects. The Corps conducted the evaluations for federally authorized Corps navigation projects. (For the purposes of this EIS, federally authorized navigation projects include Corps projects authorized under various River and Harbor Acts as well as all other federally operated channels such as Navy, U.S. Coast Guard, NOAA, etc.) In the case of Corps navigation projects, Seattle District developed testing procedures, developed programmatically for Corps projects, were also required, as appropriate, for non-Corps permit applicants.

Case-by-case evaluations did not provide local authorities with sufficient assurance that aquatic resources at the disposal sites were being adequately protected. The Puget Sound area is unique relative to other regions of the Nation in that local governments also play a key role in dredged material disposal, through their shoreline master programs, under the State shoreline permit process. Local jurisdictions can condition or restrict dredging and dredged material disposal.

The lack of fully consistent evaluation procedures, or specific objective decision criteria led, in part, to the establishment of interim disposal criteria by EPA and Ecology for the Fourmile Rock disposal site in Seattle's Elliott Bay in 1984 and the Port Gardner site near Everett in 1985. The Fourmile Rock criteria became a condition of the local shoreline permit issued by the city of Seattle to DNR and the Port Gardner criteria a condition of the city of Everett permit for the existing Port Gardner site. Subsequently, in

1985, Ecology developed the Puget Sound Interim Criteria (PSIC) to ensure that the other Puget Sound disposal sites did not experience similar problems. These criteria have been used in the interim pending development of regional Sound-wide guidelines for dredged material disposal.

An analysis of historical trends in costs of dredged material testing and disposal costs is provided in section 5.02 of the FEIS. The analysis shows that costs increased significantly after 1984 due to the interim criteria.

For purposes of assessing this option for the No Action alternative, it was assumed that the PSIC would be adopted for all Phase I disposal sites when existing shoreline permits expired. On June 7, 1987, the permit expired for the Fourmile Rock disposal site. The permit for the Commencement Bay site expired in June 1988. Also, it was assumed that the existing disposal sites would be reopened with new shoreline permits granted by local jurisdictions without any special conditions of site use. However, discussions with local shoreline juridictions have clearly indicated that, in the absence of PSDDA or a comparable comprehensive regional study (requiring substantial funding and interagency involvement), there is little likelihood that new shoreline permits would be issued for the existing Phase I area sites. The locations of several of these sites have been opposed by local citizens and environmental groups aside from the lack of consistent and objective disposal guidelines. In the absence of new local shoreline permits, the existing DNR disposal sites would not be available. Continuing past management practices is not considered an appropriate definition of No Action as the basic premises of this option are viewed as unrealistic.

c. <u>No Designation of Public Multiuser Unconfined, Open-Water Disposal Sites</u>. The No Action alternative that has been carried forward for the PSDDA study is "no designation of public multiuser unconfined, open-water disposal sites." This option is felt to be the best assessment of the No Action alternative (what would likely result in the absence of PSDDA), based on discussions with affected local shoreline jurisdictions, PSWQA, and the Washington Public Ports Association. Conditions that led to PSDDA would still exist in the absence of PSDDA, with local shoreline jurisdictions expected to deny shoreline permits for public multiuser sites and most projects until a comprehensive regional plan for dredged material management has been completed. However, limited unconfined open-water disposal may continue on a project by project basis where dredged material meets the PSIC, and local shoreline jurisdictions are willing to grant conditional use permits. This would likely occur in cases where the disposal will either have a beneficial use or the appropriate environmental impact studies will have been undertaken. This disposal would occur at project-sponsor identified sites, if environmental impacts are acceptable and project need is adequately demonstrated. All other dredged material would be placed in the nearshore or upland environment. Confined aquatic disposal (CAD) is presumed to be substantially precluded because the same site location requirements would apply to CAD sites as those required for unconfined, open-water sites. Under this No Action alternative dredged material passing PSIC could be used to create nearshore wetland environments as well as underwater reefs and island habitats. Also, dredged sediments could be used as clean fill material, or as

a cap for isolating sediments containing chemicals of concern from interaction with aquatic biota. A recent example of this is the Metro proposal to place clean sands from the head of the Duwamish River navigable channel (the Corps Seattle Harbor Navigation Project) as a cover for sediments located outside the Denny Way Combined Sewer Outfill (CSO). This would allow Metro to identify these chemicals that are still being actively discharged from the CSO, and at what rates.

The dredging volumes to be discharged at unconfined, open-water areas, under this alternative, were estimated from an assessment of the dredged materials expected to meet PSIC (2,250,000 c.y./15 years). Unconfined, open-water disposal would be likely for only those projects that would use these materials for "beneficial uses" (such as habitat development, beach stabilization, or capping of relatively contaminated areas), and those projects that are sufficiently in the public interest to warrant approval of unconfined, open-water disposal at other locations. As considerable expense is associated with disposal site studies, only the larger projects would be expected to have the resources needed to gain approval for disposal in open-water areas of central Puget Sound.

This No Action alternative complies with the Council on Environmental Quality (CEQ) regulations and provides a clear benchmark for comparing the environmental effects of the action alternatives (per regulation requirements).

Selection of the No Action alternative for PSDDA would have resulted in a number of potentially severe economic and environmental consequences which are detailed in section 4 of this FEIS. In general, most dredged material under this alternative (estimated to be almost 90 percent of forecasted volume) would require confined disposal on land or at nearshore sites. Locating and developing acceptable confined upland and nearshore disposal sites is a complex and expensive task. Public and agency approval is increasingly difficult to achieve for any disposal site located nearby to residential or recreational areas. Potential adverse effects to intertidal habitat, wetlands, land habitat and ground water resources are also considerations for siting and construction of nearshore and upland disposal sites. Dredgers seeking permits for development of a confined disposal site have found the process expensive, and subject to significant delays.

2.03 Identification of Unconfined Open-Water Disposal Sites.

a. Overview of Site Identification Process. The site identification process employed by PSDDA utilized existing information in combination with field studies to identify preferred and alternative disposal sites. The approach used is similar to that described in the EPA and Corps workbook entitled "General Approach to Designation Studies for Ocean Dredged Material Disposal Sites" (EPA, 1984). Steps of the site identification process were as follows:

(1) Define general siting philosophy. (This step addresses disposal philosophy (i.e., whether sites should be dispersive or nondispersive), general siting locations (i.e., ocean, strait, or sound), and number of disposal sites.)

(2) Identify selection factors to delineate Zones of Siting Feasibility (ZSF's). (This step uses existing information on biological resources and human use activities to identify general areas where disposal sites might be appropriately located.)

(3) Conduct field studies on the ZSF's. (Field and model studies are conducted to fill key data gaps and gather information on the physical and biological conditions of the ZSF's. Since these studies were conducted to check the general condition of the ZSF's, they are sometimes referred to as "checking studies.")

(4) Identify preliminary sites within the ZSF's. (Information from the ZSF studies is used to identify preliminary locations for disposal sites within the ZSF's.)

(5) Conduct field studies on the sites. (Field and model studies are conducted to obtain needed physical and biological information for the preliminary sites. These studies are referred to as "site-specific studies.")

(6) Identify preferred sites. (Information from the site-specific studies is used to identify preferred and alternative sites.)

These steps, which generally follow the illustrated outline in table 2.1, are described futher below. Detailed descriptions of the site identification process, study results and ZSF and site conditions are contained in the Disposal Site Selection Technical Appendix (DSSTA).

Existing DNR disposal sites were considered in the disposal site identification process if they met site identification factors discussed below. It was agreed at the beginning of the PSDDA study, that no special status, a priori, would be given to the existing sites as the intent was to establish the best possible locations for dredged material disposal. An objective site identification process was used to minimize environmental and human usage conflicts as much as possible, and existing sites adequately meeting the site identification factors and constraints were given equal consideration with other potential sites.

b. Disposal Philosophy. Also early in the study, it was decided that the Phase I area open-water unconfined disposal sites should be located where tidal currents are generally low, i.e., in areas where sediments tend to accumulate and where dredged material would tend to stay. Such areas were defined as having relatively nondispersive environments. Placing dredged material in nondispersive sites gives site managers the ability to maintain control and accountability over site conditions. This is particularly important when chemicals of concern may be present in the dredged material and it is necessary to minimize the exposure of important resources to these chemicals.

The ability to monitor disposal site operations, to modify disposal practices, and to conduct any necessary site remedial actions, are all advantages of the nondispersive siting philosophy. At dispersive sites, where currents are high and therefore capable of spreading sediments over a large area, monitoring and assessment of impacts is difficult.

c. General Siting Locations. General areas available for unconfined, open-water disposal include the Pacific Ocean, the Strait of Juan de Fuca, and Puget Sound. Discussion of each area follows.

(1) Ocean Disposal. While disposal of dredged material within State waters is governed by the CWA and the Section 404(b)(1) Guidelines, disposal beyond State controlled waters (usually 3 miles off the coast in the open ocean), is regulated by guidelines developed under the Marine Protection, Research and Sanctuaries Act (Public Law 92-532, as amended). The ocean dumping regulations require application of specified criteria to evaluate dredged material and the use of formally designated disposal sites. At the present time, there are no designated ocean disposal sites in the Pacific Ocean west of Cape Flattery.

The EPA ocean dumping criteria (40 CFR, Part 228) state that final site designation under Section 102(c) (applicable to Section 103) of the Marine Protection, Research, and Sanctuaries Act of 1972 must be bassed on environmental studies of each site and on historical knowledge of the impact of dredged material disposal on areas similar to such sites in physical, chemical, and biological characteristics. The following are the general criteria (40 CFR 228.5) and the specific factors (40 CFR 228.6) that must be considered prior to site designation. General criteria for the selection of sites are as follows:

(a) The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.

(b) Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.

(c) If at any time during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in 228.5-228.6, the use of such sites will be terminated as soon as suitable alternative disposal sites can be designated.

(d) The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and to permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as part of the disposal site evaluation or designation study.

(e) EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used.

The costs associated with barge transport of dredged material to the ocean are extremely high. Estimated unit costs of barge transport ($/c.y.) to potential ocean disposal sites 10 or 50 nautical miles (nmi) off Cape Flattery (the Cape is approximately 124 nmi from Elliott Bay) range as follows: from Port Gardner: $31.55-$41.55/c.y.; from Elliott Bay: $33.05-$43.05/c.y.; and, from Commencement Bay: $38.25-$48.25/c.y. These costs are in addition to dredging costs. The cost analysis is contained in EPTA.

Prior to any disposal, permitting and EIS procedures similar to PSDDA would be required for site designation and use. Additionally, site management conditions for ocean disposal are comparable to those which are being developed by PSDDA. Therefore, it is highly unlikely that dredged material evaluation procedures used for ocean disposal would be less restrictive than those proposed for the Phase I area. Environmental benefits or savings which might offset transportation costs are not anticipated. Also, conducting disposal operations in the open ocean environment can be difficult and at times hazardous due to periodic high winds and waves from storm activity, especially during the fall, winter, and early spring seasons.

Accordingly, ocean disposal has been ruled out as a viable alternative to disposal sites at Port Gardner, Elliott Bay, and Commencement Bay. This is not a reasonable disposal option because of decreased safety, much higher costs and no offsetting environmental benefits.

(2) Disposal in the Strait of Juan de Fuca. Though disposal of dredged material in the Strait of Juan de Fuca is regulated under Section 404 of CWA, many of the concerns for this option are similar to those of ocean disposal. Dredged material evaluation procedures would probably be similar to PSDDA procedures and therefore no real change is expected in dredging volumes that are accountable for unconfined, open-water disposal.

The transport costs for this option are also very high. Estimated unit costs ($/c.y.) of barge transport from the Phase I areas to a potential disposal site at the mouth of Cape Flattery within the Strait of Juan de Fuca are: from Port Gardner: $29.30; from Elliott Bay: $30.80; and, from Commencement Bay: $36.30 (see EPTA for details). Frequent winter storms would cause disposal operations to be more hazardous than the more sheltered areas of central Puget Sound.

Disposal in the strait also has been rejected as a reasonable alternative to disposal sites at Port Gardner, Elliott Bay and Commencement Bay, because of decreased safety and lack of environmental benefits which would offset the much higher transportation costs.

(3) Puget Sound. The remaining potential open-water disposal sites are located within the PSDDA II study area. There is no discernible gain in environmental benefits that would offset increased costs from transporting Phase I area dredged materials to either the northern or southern portions of the Sound (Phase II areas).

Therefore, only dredging and open-water disposal sites within the confines of the PSDDA Phase I area are addressed in detail.

d. Number of Sites. The major areas of dredging activity were identified for the Phase I area to determine the number of disposal sites needed. A review of dredging records revealed that the largest quantities of dredged material are generated in waterways located at Everett, Seattle, and Tacoma. Dredging at other locations of central Puget Sound is less frequent and generates substantially less volume of material. The three cities are located nearly equal distances from each other and on the edge of naturally deep harbors which have low-energy or nondispersive environments.

Per table 2.1, "one or two," "three," and "four or more" regional disposal sites were considered for the Phase I area. The one or two disposal site option, would impact less total bottom acreage than the three, or four or more options. While it would benefit the cities located near the site(s), it could have significant economic repercussions for the other city(s) due to transportation cost differences and therefore this option was rejected.

The four or more disposal sites option is also considered undesirable. Little economic benefit would be realized by designating sites outside the major dredging areas, and site management responsibilities and costs would be increased. Also, more bottom area would be impacted than under the preferred alternative.

Historically, dredged material disposal has occured at each of the three major urban embayments. This precedent, in combination with the reasons described above, resulted in the decision to have three disposal sites for the Phase I area, one serving each of the three embayments.

e. Zones of Siting Feasibility (ZSF's) in Phase I Area.

(1) Identification of the ZSF's. Zones of Siting Feasibility (ZSF) are those areas identified based on existing information which may have the potential to accommodate open-water disposal activities. In general, ZSFs are areas which have the least conflict with the siting factors of concern. The process utilized to identify ZSF's involved four discrete steps:

Step 1. Define general ZSF selection factors.

Step 2. Define and map specific ZSF selection factors.

Step 3. Apply constraints to the identified ZSF's.

Step 4. Prioritize ZSF's for purposes of field studies.

These steps are further described below, and are addressed in detail in the DSSTA.

(a) General ZSF Selection Factors. Three general factors guided ZSF selection. These factors were:

- Tidal Currents. High tidal current (high energy) areas, where dredged material would be significantly dispersed beyond the disposal site area, were to be avoided.

- Biological Resources. Significant adverse impacts were to be avoided on foodfish, shellfish, marine mammals, and marine birds.

- Human Activites. Interference with human uses of marine waters were to be held to the lowest practicable level.

(b) Specific ZSF Selection Factors. The three general ZSF selection factors were further delineated by nineteen specific selection factors (shown in table 2.2). Most of these factors are identified in Federal and State regulations relating to dredged material disposal sites.

Information on each of the factors listed in table 2.2 was displayed on large, transparent maps of central Puget Sound. By overlaying these maps, it was possible to identify "windows" or areas between resources that might lend themselves to disposal siting with a minimum of conflict with ecological resources and other human uses of the sound. This mapping overlay process was used to determine where the disposal site ZSF's should be located. Subsequent to this analysis, additional constraints were applied to specifically determine the ZSF boundaries.

(c) Apply Constraints to Identified ZSF's. Additionally, the following constraints were imposed on ZSF boundaries:

- ZSF's were to be located a minimum water surface distance of 2,500 feet from adjacent shorelines to provide a buffer from noise and adverse environmental effects.

TABLE 2.2

SPECIFIC FACTORS FOR IDENTIFICATION OF
ZONES OF SITING FEASIBILITY

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1. Navigation activities
2. Recreational uses
3. Cultural sites
4. Aquaculture facilities
5. Utilities
6. Scientific study areas
7. Point pollution sources
8. Water intakes
9. Shoreline land use designations
10. Political boundaries
11. Location of dredging areas
12. Beneficial uses of dredged material
13. Fish/shellfish harvest areas
14. Threatened and endangered species
15. Fish/shellfish habitat
16. Wetlands, mudflats and vegetated shallows
17. Bathymetry
18. Sediment characteristics
19. Water currents

---

o ZSF's should be buffered from vulnerable biological resources by a minimum distance of 2,500 feet as measured along the water surface.

o ZSF's should be located in water depths greater than 120 feet. Water depths of less than 120 feet are generally more productive and of major importance to many of Puget Sound's important commercial fish species.

o ZSF's should be located in water depths of less than 600 feet. Based on model results, water depths greater than 600 feet could result in substantially more dispersion of the dredged material during descent through the water column.

It is important to note that the selection factors and constraints were viewed as reasonable value judgments by the Disposal Site Work Group, for purposes of planning, and should not be taken as inviolate standards. Details concerning this process are provided in the DSSTA.

(d) Prioritization of ZSF's for Purposes of Field Studies. ZSF's were further divided into priority 1 and 2 rankings based on their proximity to major dredging areas. The rankings served to identify areas that would receive first consideration for studies to locate potential sites. Typically, priority 1 ZSF's were located within 10 nmi of major dredging areas. If acceptable sites could not be found in priority 1 ZSF's; priority 2 ZSF's would be studied.

(2) Description of the ZSF's. All ZSF's identified by PSDDA in central Puget Sound are shown in figures 2.1 and 2.2. The priority 1 ZSFs identified from this process are located in Commencement Bay, inner Elliott Bay, outer Elliott Bay, and Port Gardner (figures 2.3, 2.4, and 2.5, respectively). The limited information available for the Port Gardner ZSF suggested the need to identify a backup ZSF, pending information to be gathered from field studies. Therefore, a priority 2 ZSF in Saratoga Passage was also included for detailed studies (figure 2.6). Other priority 2 ZSF's were not studied in detail since field studies of the previous ZSF's showed them to be acceptable. The priority 1 ZSF's (plus Saratoga) are described below.

(a) Commencement Bay ZSF. (Figure 2.3) Boundary delineations for the Commencement Bay ZSF were largely determined by the water depth criteria (between 120 feet and 600 feet) and the 2,500-foot shoreline buffer. Biological resource conflicts were minimal within the ZSF boundary. The existing DNR disposal site is located within the priority 1 ZSF.

(b) Elliott Bay ZSF's. (Figure 2.4) The northern ZSF in Elliott Bay is located off Fourmile Rock and is shaped roughly like a football. The southwest boundary of the football was constrained by tugboat routes and cable crossings, while the inshore boundary was determined by the 120-foot depth limitation and an anchorage area. The western corner of the ZSF encompassed the existing DNR disposal site known as Fourmile Rock disposal site. The inner Elliott Bay ZSF is located north of the mouth of the Duwamish

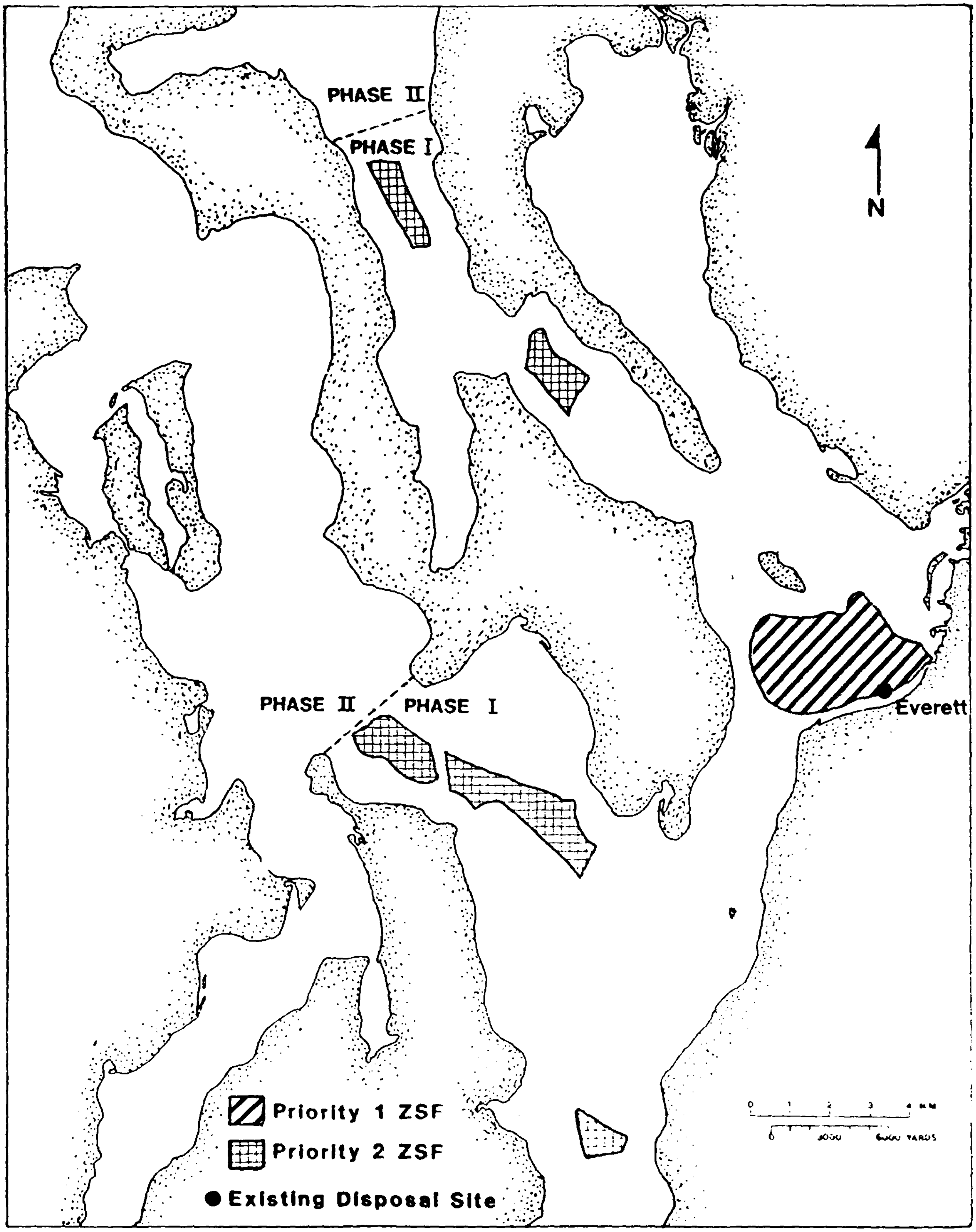


Figure 2.1: Zones of Siting Feasibility, Phase I (northern portion)

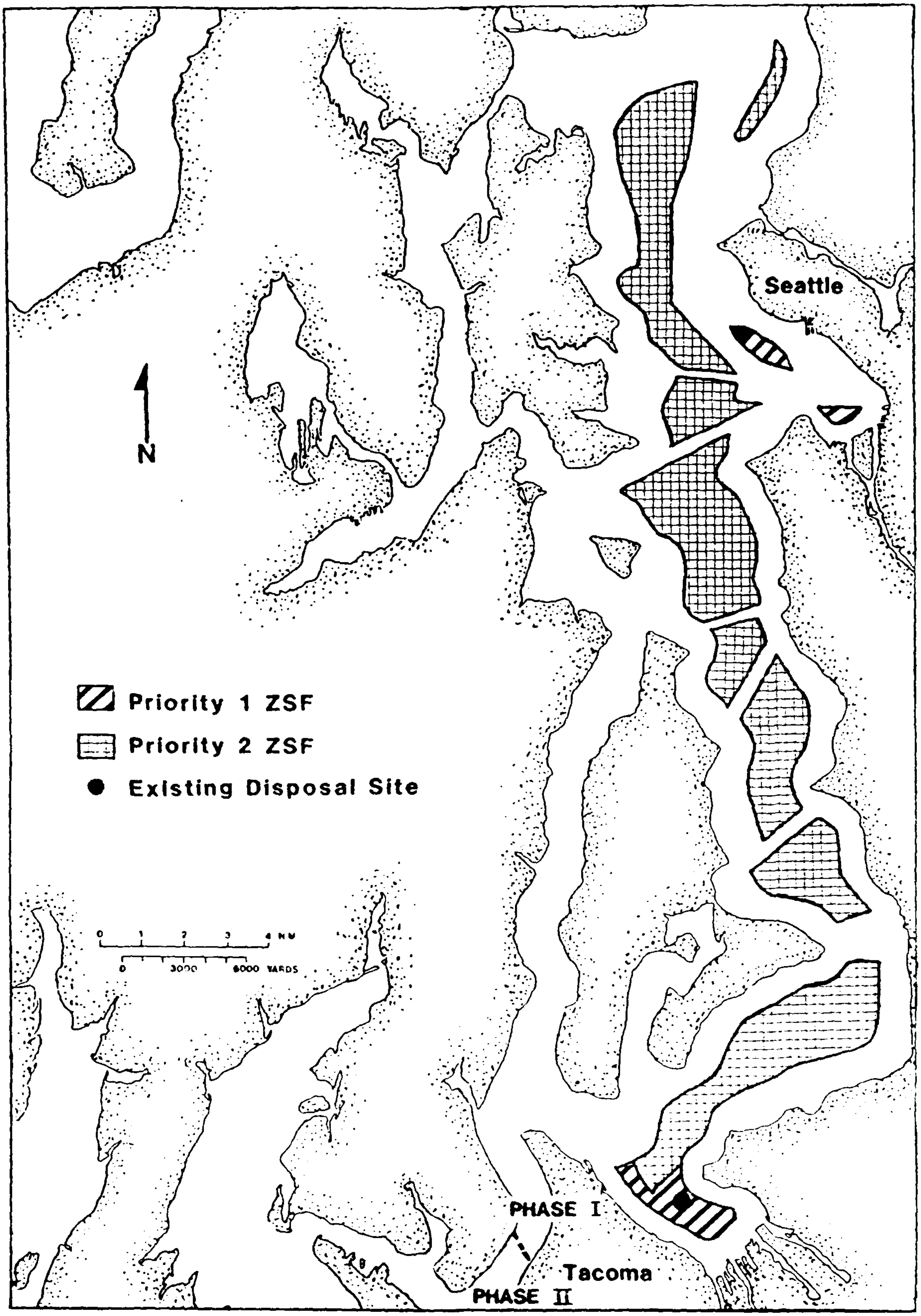


Figure 2.2: Zones of Siting Feasibility, Phase I (southern portion)

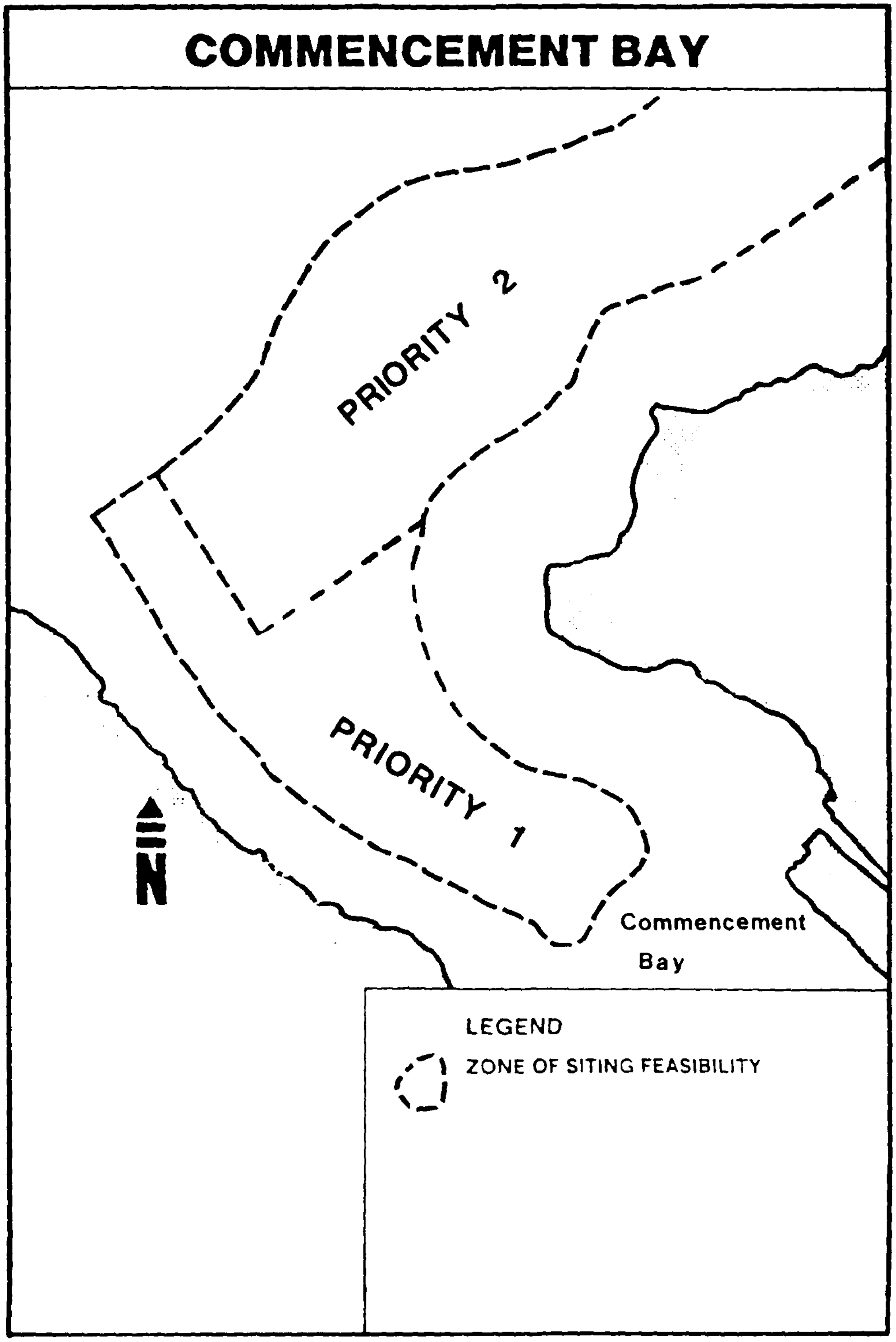


Figure 2.3: Zones of Siting Feasibility, Commencement Bay

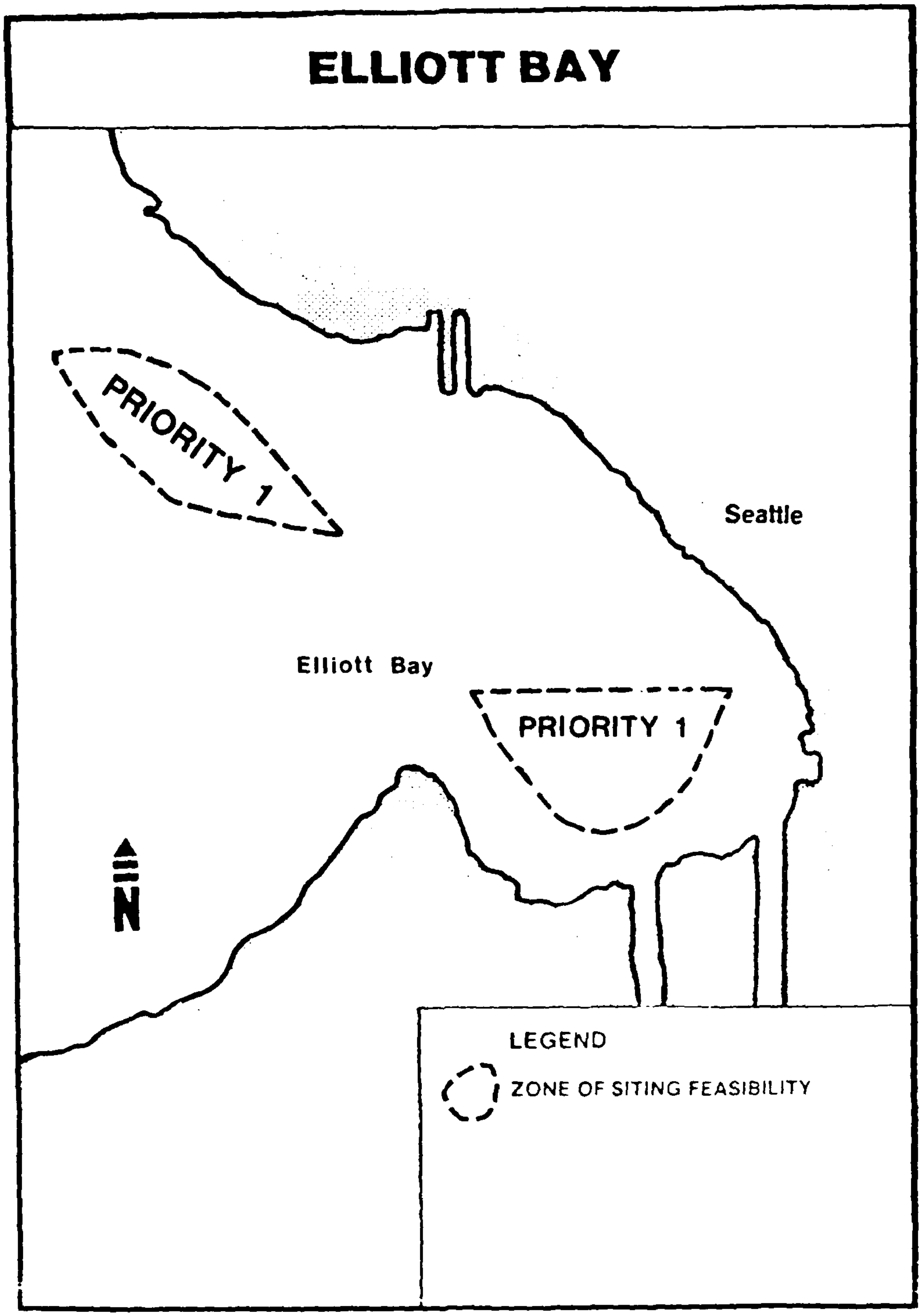


Figure 2.4: Zones of Siting Feasibility, Elliott Bay

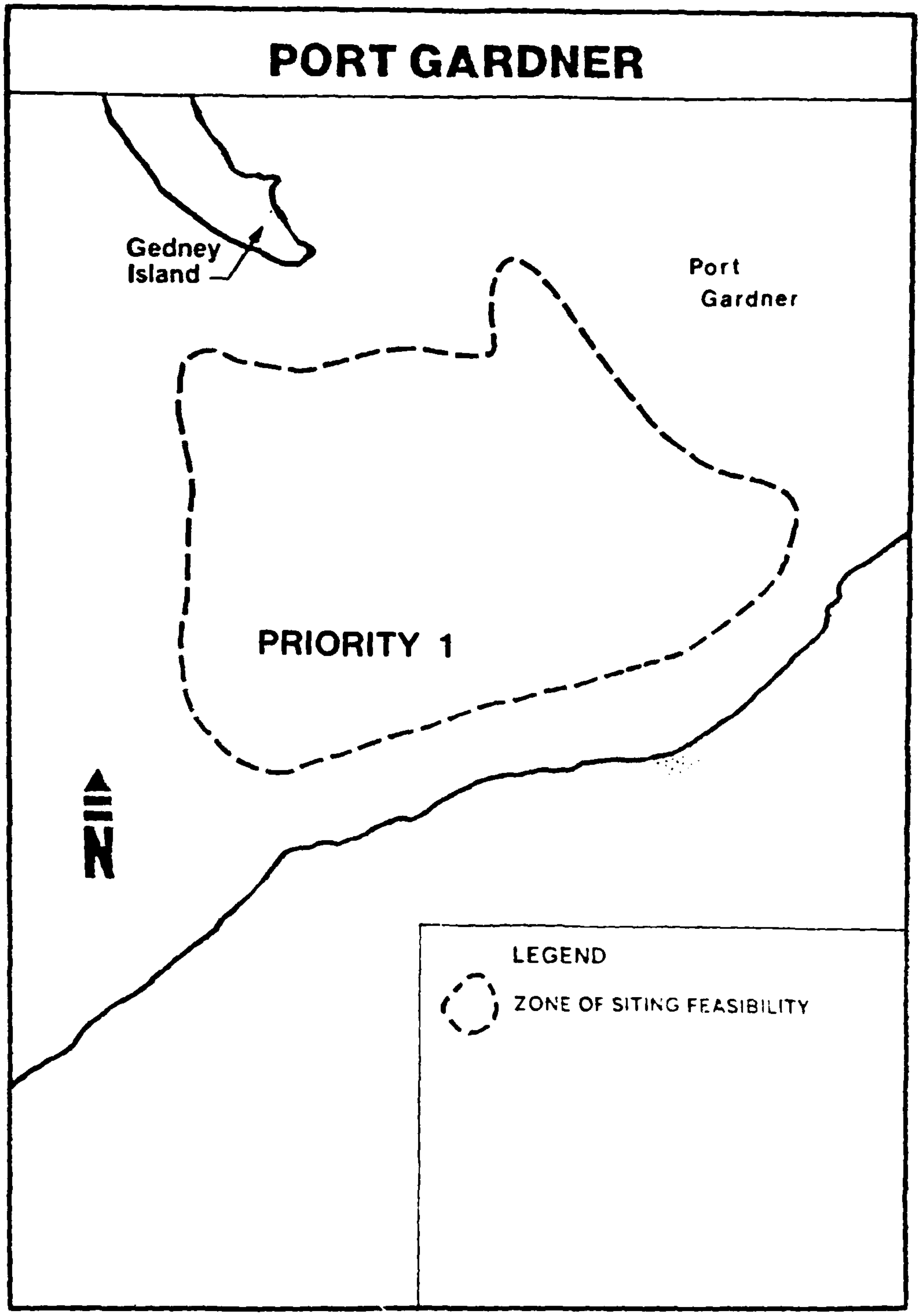


Figure 2.5: Zones of Siting Feasibility (priority 1)
in Port Gardner

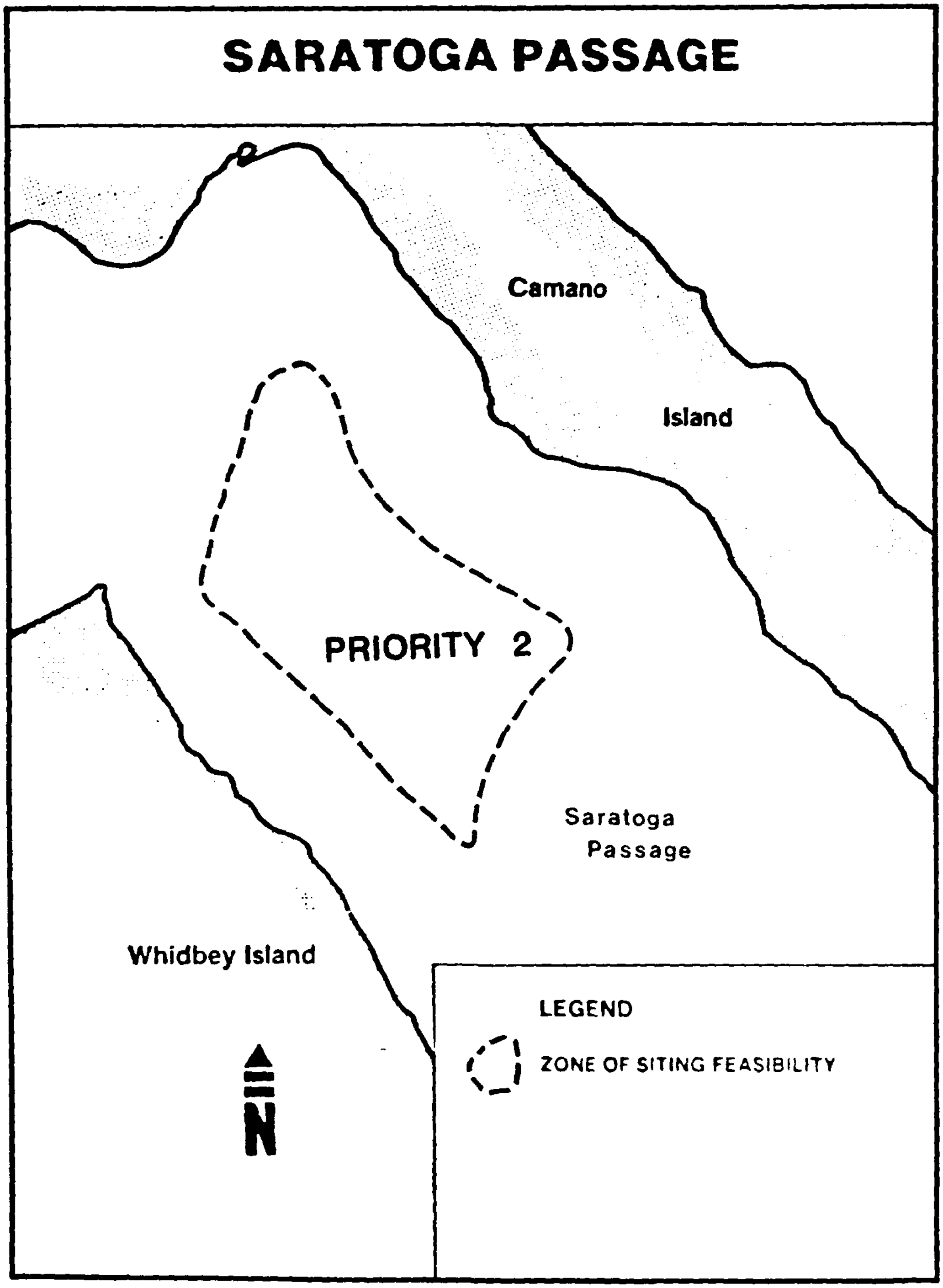


Figure 2.6: Zone of Siting Feasibility (priority 2) in Saratoga Passage

River. The boundaries of the inner Elliott Bay ZSF were determined by ferry crossings on the north, anchorage areas and navigation lanes to the south and east.

(c) Port Gardner ZSF's. (Figure 2.5) The Port Gardner ZSF was established using the constraints of water depth (i.e., deeper than 120 feet and shallower than 600 feet) and a 2,500-foot buffer zone adjacent to the shore. Limited data existed which indicated that important fish and shellfish (notably Dungeness crab) resources might exist on all or portions of the ZSF. Because of the paucity of existing data, field studies were conducted of the ZSF to determine if these important fishery resources were indeed prevalent throughout Port Gardner. The intent was to locate areas where resource impacts could be minimized. The Saratoga Passage ZSF was identified as an alternative in the event this was not possible. The existing DNR Port Gardner disposal site was only partially located within the ZSF. Half of the site is located outside the ZSF, within the 2,500-foot buffer zone.

The Saratoga Passage ZSF (figure 2.6) is located immediately south of the mouth of Holmes Harbor. Factors determining the boundaries of this ZSF were vessel traffic, shellfish populations, and finfish harvesting to the northeast; finfish harvesting to the southeast; cable routes and crab populations to the southwest; and groundfish habitats in the northwest.

f. ZSF Field Studies. Though initial overlay mapping was used to establish ZSF's, this mapping also pointed out several key information gaps. Accordingly, a series of field studies were undertaken to verify information derived from the maps and to provide the basis for selecting potential disposal sites within the ZSF's. These field studies are described in detail in DSSTA.

Data collection activities focused on those areas where information was lacking. The mapping data used for the priority 1 ZSF selection indicated that little or no conflict with human, shoreline and shallow water uses and values would occur. However, adequate physical and biological data, sufficient for disposal site selection, were lacking for all of the priority 1 ZSF's. Therefore, field studies focused on two critical issues:

o What is the depositional/erosional (nondispersive/dispersive) nature of areas within each ZSF? Can acceptable nondispersive (low tidal current) sites be identified?

o What is the value of the priority 1 ZSF's to biological resources of concern (i.e., crab, bottom fish, and shrimp). (Focus was placed on species which would be in direct contact with the dredged material on the sea floor.)

(1) Survey of Bottom Conditions. A submersible remote operational vehicle (MANTA), collected physical bottom data with a sidescan sonar, and attempted to obtain data on biological resources through use of a video camera

and 35 millimeter stereo still cameras. This survey unfortunately was undertaken immediately following a large storm event in November of 1985. Turbidity in all deep central Puget Sound water at this time was extremely high. Still photographs and video efforts were of little use. However, the sidescan sonar effectively characterized bottom contours and identified larger features of the bottom.

(2) Sediment Vertical Profiling System (SVPS) Survey. A special sediment vertical profiling system (SVPS) device, allowing cross-sectional photographs to be taken of the upper 16 centimeters (6.3 inches) of the seafloor bottom sediments, was used to check the ZSF's. Van veen grab samples were taken to ground-truth the SVPS observations. A computer imaging analysis system is then used to provide information on physical and biological (infaunal benthos) characteristics. The SVPS identified general areas that are depositional in nature.

(3) Depositional Analysis of the Sediments. The objective of the depositional analysis was to locate areas within each ZSF where sediments tend to deposit rather than erode. Previous work by Word, et al. (1984a) indicated that sediments in Puget Sound tend to accumulate where existing sediments meet the following four conditons (when compared to sediments at similar depths): (1) abnormally small grain size; (2) abnormally high volatile solids; (3) abnormally high water content; and (4) abnormally high biochemical oxygen demand (BOD). Over 200 stations were occupied to collect sediment samples for this technique. Study results were used to identify areas that were most nondispersive within each ZSF. The reader is referred to the DSSTA, Part 5, for a complete description of the methods and results of this study.

(4) Current Velocity Studies. Current strengths at each ZSF were assessed from the following: (1) a review of historical field data (including current meter work undertaken for PSDDA and the Navy in Port Gardner), (2) application of a mathematical model simulation of tidal currents, (3) predicted current velocities from a physical hydraulic model, and (4) current meters placed during the Phase I field studies at the existing disposal sites in Elliott Bay and Port Gardner. The DSSTA provides a detailed discussion of these studies.

Results indicate that all the priority ZSF's are in relatively low current velocity areas (see DSSTA). Material deposited at the preferred sites should generally remain there.

(5) Crab, Shrimp and Bottom Fish Trawling Studies. The distribution and relative abundance of important commercial dungeness crab, shrimp and bottom fish resources were mapped in and around all priority ZSF's from data obtained during seasonal sampling cruises. The objective was to evaluate the importance of the ZSF's in general to these commercial natural resources, and to minimize impacts as much as possible as part of the site identification process by helping to locate areas of relatively lowest habitat value.

Results indicated disposal sites can be located within the priority ZSF's yet still avoid significant conflict with each of these resources.

g. Preliminary Site Identification. Preliminary disposal sites within the ZSF were identified using information obtained via ZSF identification and field studies. Two factors were emphasized in locating the disposal sites: (1) a low abundance of commercially important animals (i.e., small numbers of crab, shrimp, and bottomfish); and (2) the presence of a relatively nondispersive area (i.e., sediment and current characteristics indicating that sediments would stay at the disposal site).

Preliminary sites were identified in all the priority 1 ZSF's. As a result, two sites were specified in Elliott Bay, two sites in Commencement Bay and two sites in Port Gardner. Additionally, a site was also identified in the Saratoga Passage ZSF. These sites were later treated as alternatives for purposes of planning and NEPA/SEPA compliance.

h. Site Field Studies. Additional studies were conducted for the preliminary sites to define the size of the bottom impact area and to refine site location relative to food web values of these areas.

(1) Numerical Dump Model. To assist in establishing the size and location of the disposal sites, a numerical model, originally developed for EPA and later refined by the Corps' Waterways Experiment Station, was used to estimate the depositional pattern caused by the disposal of a single bargeload of dredged material (Trawle and Johnson, 1986). The model was run for two types of dredged material at several depths and current speeds. Result from this model were combined with an estimate of the probable surface disposal zone to provide an initial assessment of the sediment deposition pattern that might be caused by repeated disposals within a site. The model results indicate that the impact of any one barge load (1,500 c.y.) of material is confined to a relatively small area. In 400 feet of water the descending cloud is approximately 250 feet in diameter (B. Trawle, personal communication) when it hits the bottom, occuring 30 seconds after disposal is initiated. The collapsing cloud then spreads out in all directions. Ten minutes later, essentially all of the material is deposited on the bottom within a 1,000-foot radius of the drop point. The thickness of the deposited material varies from about 0.3 inches at the center of the disposal mound to 0.04 inches at the edge. These results assume a worst-case spread of a completely slurried load. Dredged material with cohesive clumps would not spread as far or as thinly. The final size, orientation, and configuration of the disposal sites are not significantly affected by the materials deposited from any single barge disposal, but are governed by the total amount of material being deposited, sediment bulking factors, stable side slope characteristics of the sediments, existing bottom topography and consolidation characteristics of both the bed and dredged material. The model studies were used to define the bottom impact area, described below, for each of the sites.

(2) Food Web Study. Benthic resources within and adjacent to each of the preliminary disposal sites were evaluated in terms of their food support potential to bottom fish resources. A procedure called the Benthic Resources Assessment Technique (BRAT) developed by the U.S. Army Waterways Experiment Station (Lunz and Kendall, 1982), was used to quantify the food value of

bottom-dwelling organisms within soft-bottom habitats to bottom-feeding fishes. Through BRAT estimates can be made of which organisms at a given site are both vulnerable and available to selected foraging fish species.

Different species of bottom-feeding fishes can detect, capture, and ingest only a portion of the available benthos. They will consume different prey at different locations and seasons, reflecting the availability of vulnerable prey. In BRAT, vulnerability is taken to be a function of the size of the benthic food item, and availability of the prey's location below the sediment-water interface. Both factors are estimated from an examination of the diets of target predatory fish, and confirmed by a parallel examination of vulnerable and available prey in the local benthic environment. Food web linkages between benthic organisms, key fish and shellfish, and ultimately humans via commercial and recreational fisheries offers resource managers a way of assigning comparative resource values to alternative disposal sites. See the DSSTA, Part 9, for a complete description of the methods and results of this procedure.

As with the trawling studies, BRAT confirmed that resource values at the preliminary disposal sites within the priority 1 ZSF's are equal to or lower than surrounding areas. Consequently, adjustments to site locations were not considered necessary.

i. Sites in Commencement Bay Area. Preferred (selected) and alternative sites in the Commencement Bay ZSF (figure 2.7) were identified based on results of ZSF and site-specific studies.

(1) Commencement Bay: Site Selection. Studies showed that benthic resource values were relatively low in both the selected and alternative sites, and were lowest at the selected site. No crab resources were found in either site, and shrimp and bottomfish resources were also documented as low to impoverished in each of the two sites. The selected site was chosen over the alternate site primarily because it lies in an area where sediments appear to be stable, nondispersive and more depositional in nature than the alternative site. The selected site was also located somewhat closer to the center of dredging activity than the alternate site.

Further discussion on site selection is provided in section 4.

(2) Commencement Bay Site 1 (Selected Site). The center of the Commencement Bay selected site is located at latitude 47d 18.22m and longitude 122d 27.84m and lies approximately 1 mile west of Browns Point (figure 2.7). The center of the existing DNR disposal site is located 0.9 mile southeast of the center of the selected site. The selected site is elliptical in shape, covering approximately 310 acres, with a long axis of 4,600 feet oriented parallel to the tidal current flood-ebb direction and short axis of 3,800 feet. The bottom slope at this site is approximately 1-foot vertical to 200 feet of horizontal distance, which is essentially flat. The proposed site lies in an area where sediments tend to deposit rather than erode, as

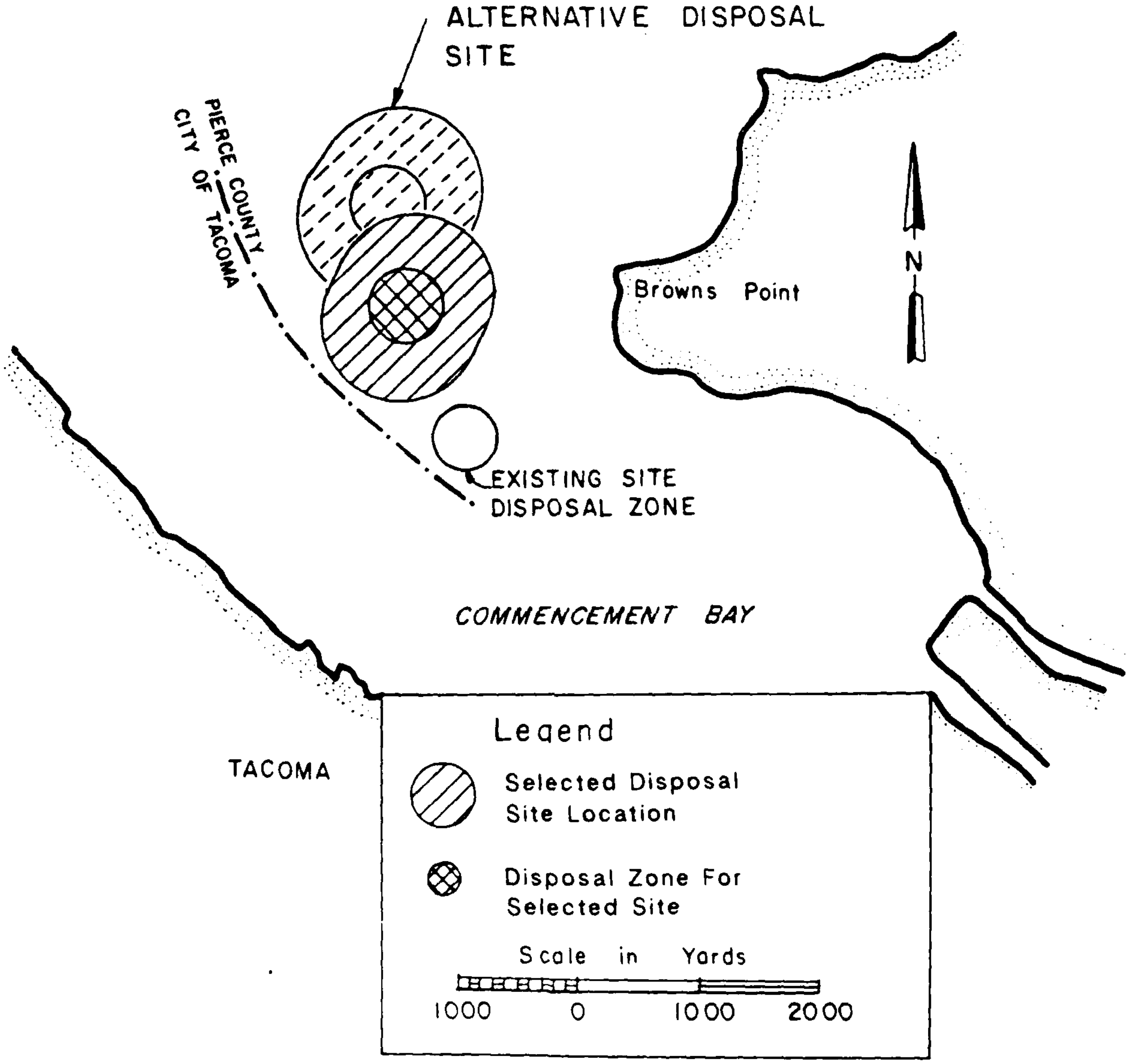


Figure 2.7: Alternative Commencement Bay Disposal Sites

suggested by clay composition exceeding 15 percent, water content exceeding 50 percent, volatile solids exceeding 4 percent, and biochemical oxygen demand exceeding 500 (data summary from Depositional Analysis). The small grain size (i.e., medium silt) suggests that current speeds lie below the 25 centimeter per second threshold; and are backed up by numerical model results suggesting peak speeds of 18-20 centimeters per second. At this current speed, dredged materials disposed should not be resuspended by local currents. Net current direction appears to be toward the southwest and the site is oriented accordingly.

(3) Commencement Bay Site 2. The center of the other disposal site is located at latitude 47d 18.72m and longitude 122d 27.95m and a portion of the site overlaps the northern one-third of the preferred site (figure 2.7).

The site has the same elliptical shape, dimensions and orientation (southwest) as the preferred site (4,600 feet by 3,800 feet) and lies within the same bathymetric depth range of 540-560 feet. Sediment characteristics are similar to those of the preferred site (i.e., medium silt). The bottom side slope conditions are also similar to those of the selected site (i.e., 1 on 200), depicting a relatively flat bottom.

j. Sites in Elliott Bay Area. Selected and alternative sites for the two Elliott Bay ZSF's were identified based on results of ZSF and site-specific studies.

(1) Elliott Bay: Site Selection. Site specific studies of the alternative sites in Elliott Bay (figure 2.8) indicated that both sites exhibited relatively low benthic resource values, although the selected site in inner Elliott Bay exhibited comparatively higher shrimp resources and bottomfish resources than the alternative site 2. Dungeness crab resources were nonexistent at both sites. The selected site in inner Elliott Bay was chosen over the outer Elliott Bay alternate site for the following reasons. First, the selected site is located in a more stable, low energy, and depositional environment. Studies at the alternate site indicated that there was potentially strong currents (a kinetic gradient) through the site with an attendant high likelihood of dispersion of dredged material offsite following disposal; whereas extensive studies of an experimental dump at the inner Elliott Bay site indicated that dredged material placed there had not eroded over a several year period (DSSTA). Second, public concerns about the existing Fourmile Rock site, and input during the siting process, favored selection of the inner Elliott Bay selected site over the alternate site. Third, low sediment quality has been documented over much of the selected site. Dredged material placed at the selected site could result in a net improvement of much of the area's sediment. And fourth, the preferred site is relatively closer to most of the Elliott Bay dredging activity.

Further discussion on site selection is provided in section 4.

(2) Elliott Bay Site 1 (Selected Site). The center of the selected site in Elliott Bay is located at latitude 47d 35.97m and longitude 122d

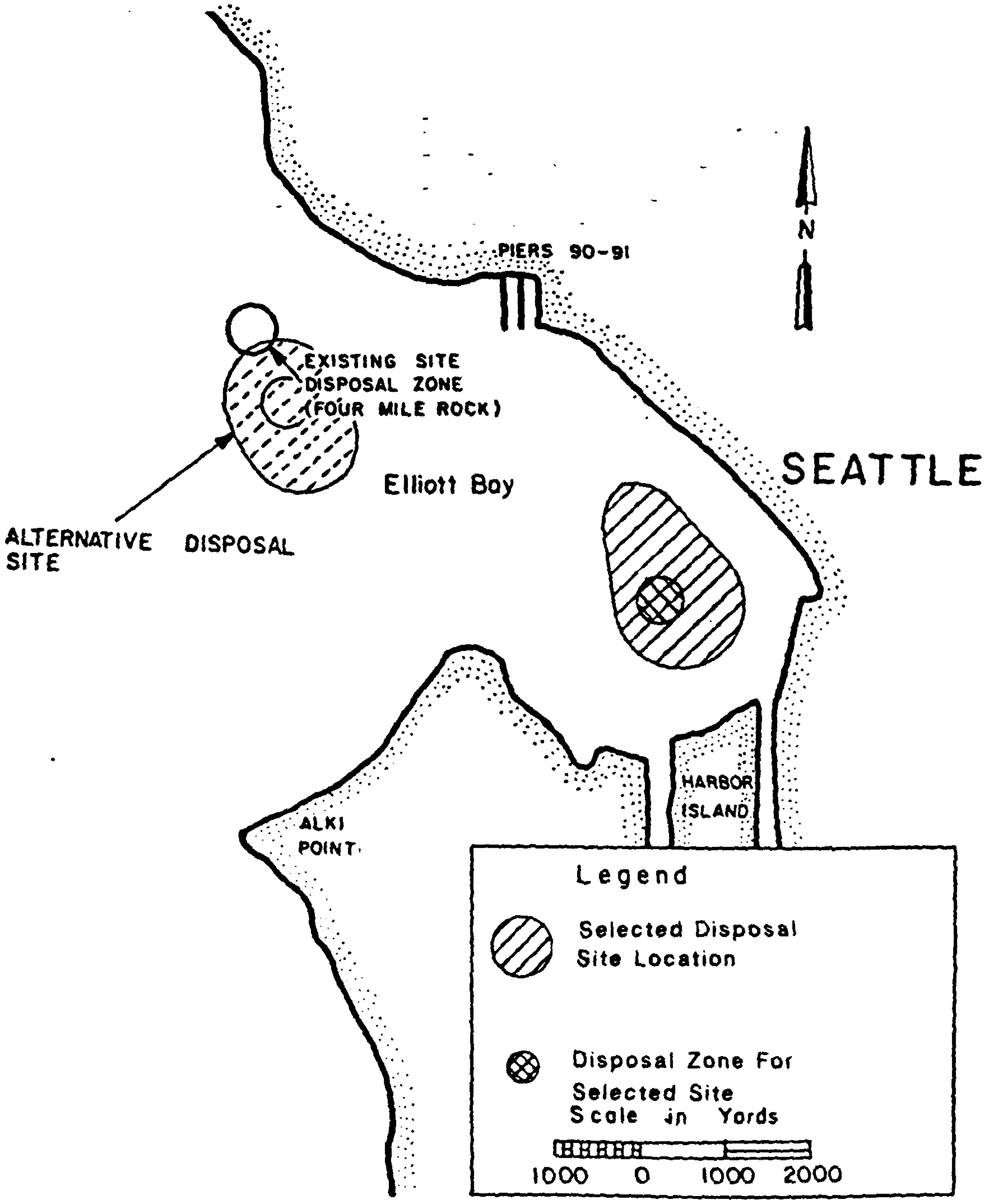


Figure 2.8: Alternative Elliott Bay Disposal Sites

21.34m within the confines of a depositional area near the mouth of the Duwamish River (figure 2.8). The disposal site is shaped like a large egg with the south end of the site located in approximately 200 feet of water and the north end of the site located in approximately 360 feet of water. The site is approximately 6,200 feet in length and 4,000 feet wide, covering 415 acres. The site is located in a submarine valley with relatively steep sides and a downward slope ranging from 1:30 to 1:50.

(3) Elliott Bay Site 2. The center of the other site in Elliott Bay is located at latitude 47d 37.09m and longitude 122d 24.85m and lies just southeast of the existing DNR disposal site (Fourmile Rock) (figure 2.8). The boundaries of both sites overlap at the northwest corner of site 2. The 480-acre site is elliptical in shape with dimensions of 4,500 feet by 6,000 feet. The long axis of the rectangle runs parallel with the northwest to southeast bottom contours. The north end of the site lies in approximately 500 feet of water, whereas the south end of the site is in 600 feet of water, with a resulting bottom slope varing from 1:30 to 1:50 across the site. The site is 4,000 feet south of Magnolia Bluff at the toe of a steep (1 foot vertical to 8 feet horizontal) slope which fronts the Magnolia shoreline.

k. Sites in the Port Gardner Area. The selected and alternative sites for the Port Gardner (figure 2.9) and Saratoga Passage (figure 2.10) ZSF's were identified based on results of ZSF and site-specific studies.

(1) Port Gardner: Selection of Preferred Site. The preferred site was selected over the alternative sites at Port Gardner and Saratoga Passage for the following reasons. First, the selected site lies in an area of weak bottom currents which is described as a depositional environment. Second, the preferred site is removed from areas of high concentrations of benthic, crab, shrimp, and bottomfish resources. Third, prevailing low currents flow in a northward to westward direction, thus, ensuring that any suspended dredged material that might move offsite would tend to move away from areas of high crab, shrimp, and bottomfish populations (DSSTA). And fourth, the selected site is reasonably close to the center of most of the dredging projects where unconfined, open-water disposal will be a consideration.

The alternative site in Port Gardner also exhibits comparably similar attributes to the preferred alternative site (i.e., low natural resources onsite, low current/depositional environment, close to dredging area), but lies proximal to high concentrations of crab, shrimp, and bottomfish resources. It was largely eliminated from further consideration because of insufficient buffer zone between the site and adjacent natural resources. In addition, the Port Gardner alternative site directly conflicts with the disposal site for the Navy Homeport project. The alternative site in Saratoga Passage was eliminated because of economic considerations, being further removed from dredging areas (i.e., greater than 10 nautical miles), and the presence of a less costly, environmentally acceptable alternative site in Port Gardner Bay.

Further discussion on site selection is provided in section 4.

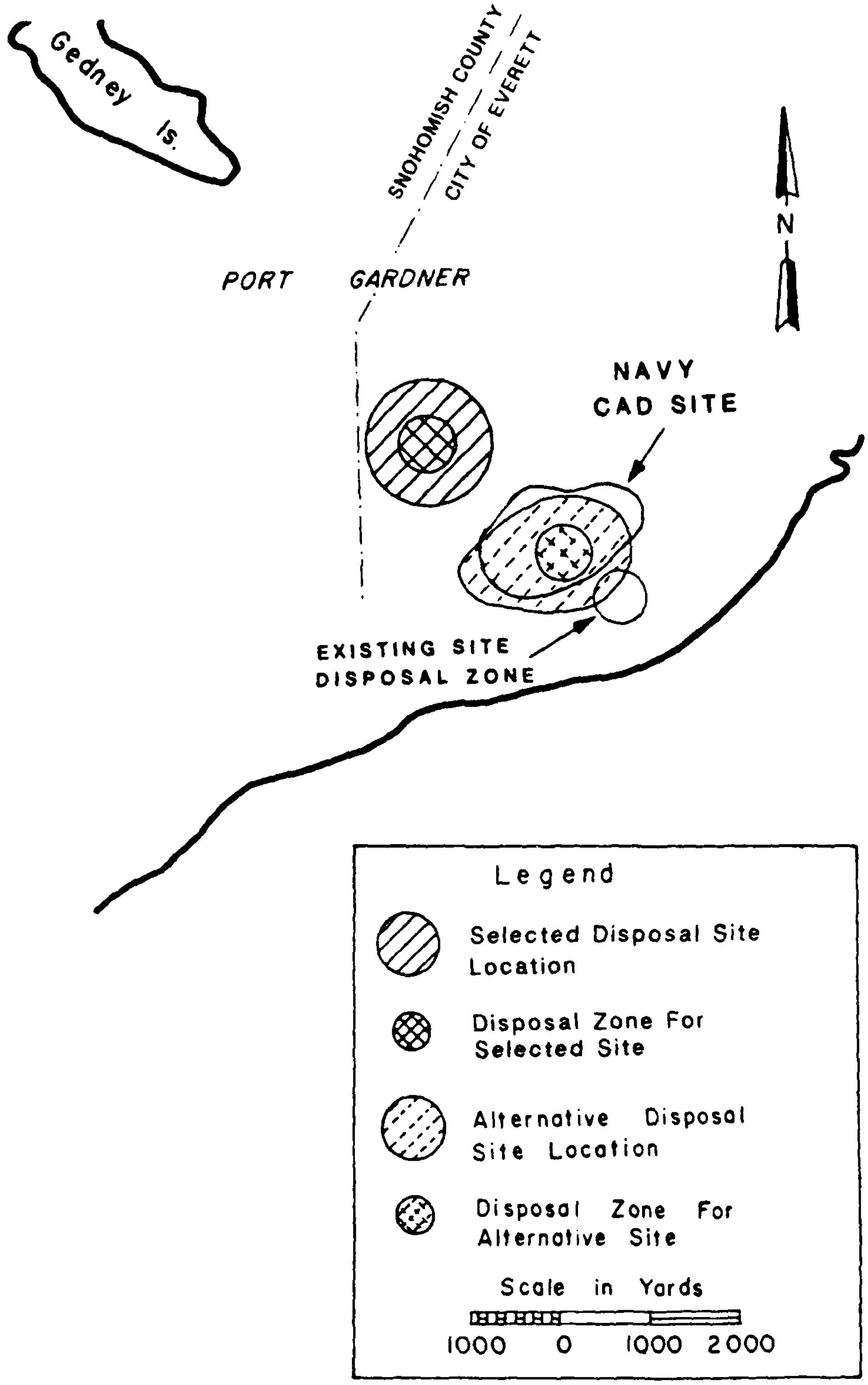


Figure 2.9: Alternative Port Gardner Disposal Sites

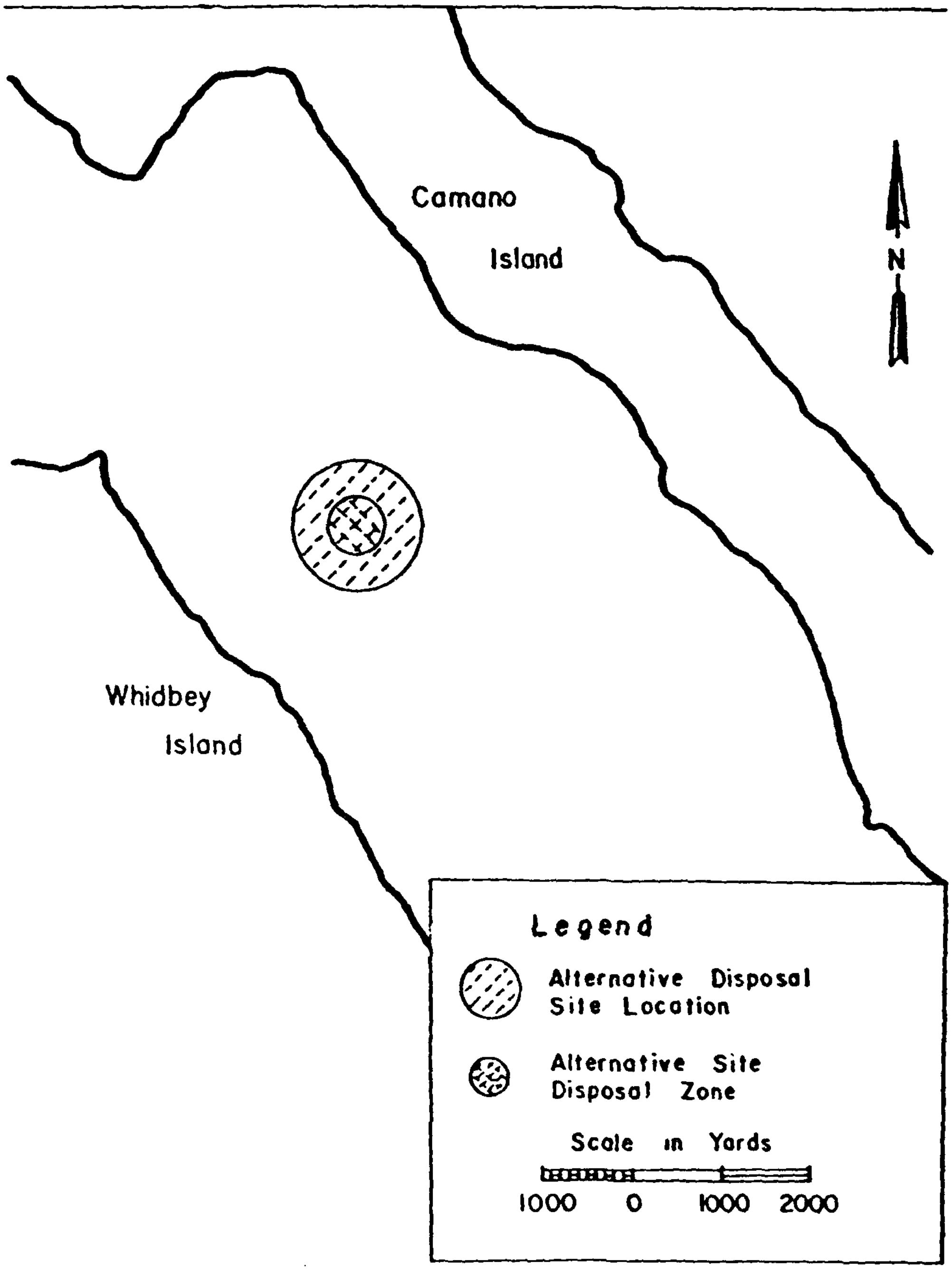


Figure 2.10: Potential Disposal Site in Saratoga Passage (alternative to Port Gardner sites)

(2) Port Gardner Site 1 (Selected Site). The center of the preferred Port Gardner site is located at latitude 47d 58.86m and longitude 122d 16.67m, and lies approximately 2 nmi west of Everett Harbor (figure 2.9). The 318-acre site is circular and located in 420 feet of water on a large flat plane with a diameter of 4,200 feet. Bottom slopes are less than 1 feet vertical on 200 feet horizontal. Because bottom slope and tidal currents should not significantly alter the disposal site configuration, the delineated site is a 4,000-foot-diameter circle that is concentric with the 1,800-foot-diameter disposal zone.

(3) Port Gardner Site 2. The center of other site in the Port Gardner ZSF is located at latitude 47d 58.26m and longitude 122d 15.55m and lies 9,000 feet southwest of the mouth of the Snohomish River and 4000 feet from the Everett shoreline (figure 2.9). The 375-acre site is egg-shaped with dimensions of 3,800 feet by 5,833 feet, with the long axis lying parallel with the shoreline. Water depths vary from 330 feet on the southeast end of the site to 425 feet to the northwest end, with a bottom sloping downward to the southwest varying from 1 V to 70 H and 1 V to 35 H, averaging about 1:40. The site is located at the base of a 1:7 slope which extends 2,000 feet from shore, and lies just north of the existing Port Gardner DNR disposal site. The southeast corner of site 2 encompasses almost half of the existing DNR site. Current speeds measured in the southeast corner of the site (i.e., in DNR site) during site selection studies, indicated that bottom currents at this location are very low.

Approximately one-half of this site may be potentially covered by the site which the U.S. Navy will use for disposal of material from the proposed Homeport facility in the East Waterway. Existing information for the Port Gardner area did not reveal any significant issues during identification of the ZSF boundaries; site 2 was initially thought to be the potentially preferred site. However, further studies indicated proximity of important resources (crabs) which could be potentially impacted from continued long-term use of the site. The site has been carried through in the EIS as a final, nonpreferred site in order to display and compare the PSDDA study information.

(4) Port Gardner Site 3 (Saratoga Passage). The center of the backup site in the Saratoga Passage ZSF is located at latitude 48d 5.43m and longitude 122d 27.35m (figure 2.10). It lies equal distance from each shoreline (approximately 1 nautical mile) and approximately 8000 feet south of East Point. The 318-acre circular site is 4,200 feet in diameter and lies in approximately 350 feet of water. The site is relatively flat with only an 18-foot variation in depth throughout the site. Current measurements, made in this area by NOAA in 1977, indicate that tidal currents rarely exceed 20 cm/sec.

2.04 Biological Effects Condition for Management of the Unconfined, Open-Water Disposal Sites. One important aspect of the management plan is the environmental conditions that will be maintained (or avoided) at the unconfined, open-water disposal sites. These conditions involve the potential for

biological effects due to chemicals that may be present in the dredged material. To address this issue, alternative biological effects levels were defined for disposal site management and an alternative selected for the Phase I area.

Five steps were taken in determining the appropriate site management condition for the Phase I area unconfined, open-water disposal sites. These steps are as follows:

Step 1. Selection of the general management approach to dredged material evaluation.

Step 2. Definition of various degrees of adverse biological effects that might occur at the sites (referred to as "biological effects conditions for site management" or "site conditions").

Step 3. Development of dredged material evaluation procedures as a means to avoid exceeding the site condition by:

(a) specifying chemical and biological testing requirements and

(b) defining disposal guidelines (test interpretation), including biological response guidelines (for biological tests) and sediment quality values (for chemical tests).

Step 4. Assessment of the environmental and economic consequences of the alternative site conditions.

Step 5. Identification of the appropriate biological effects condition for site management in the Phase I area of PSDDA.

These steps are also discussed in chapter 5 of the MPR and in EPTA. The use of the site condition in testing and evaluation of dredged material is discussed in 2.04.d.

a. Identification of Alternative Biological Effects Conditions for Site Management. The definition of acceptable adverse biological effects for the unconfined, open-water disposal sites per the Section 404(b)(1) Guidelines is not a simple, "black or white" determination. What constitutes "unacceptable adverse effects" at the site, per the CWA requires substantial professional judgment. State water quality standards also require this judgment by stating that toxic or deleterious material concentrations shall be below those which may cause acute or chronic conditions to the aquatic biota (WAC 173-201).

Complicating the development of a standard site condition for Puget Sound is the uncertainty in scientific understanding of cause and effect relationships between sediment contamination and biological response. This uncertainty leaves a large "gray area" in terms of the degree of biological effects that can exist at unconfined, open-water disposal sites and still not result in unacceptable adverse effects. Within this "gray area," what constitutes

unacceptable also depends upon individual perspective and a combination of social and economic factors which alter the relative value of aquatic resources.

A number of different definitions of the preferred biological effects condition for site management were considered (see table 2.3). At each end of the range of possible biological effects due to chemicals, extreme site management conditions were defined. At the low end of the range, one possible site management condition would be to allow only dredged material that does not contain measurable levels of any chemical of concern (referred to as Site Condition 0). Virtually all sediments expected to be dredged in Puget Sound will have some measurable levels of chemicals of concern (especially naturally occuring levels of heavy metals). As a result, use of this condition would result in no disposal of dredged material at the unconfined, open-water disposal sites. Although this option would comply with the CWA and State Water Quality Standards, (no unacceptable adverse biological effects at the unconfined, open-water disposal sites, by having virtually no discharge at the sites), it may not comply with the Federal guidelines when the consequences of disposal at wetlands and intertidal nearshore confined disposal sites are considered. This option places all environmental risk at nearshore and upland disposal sites and is considered environmentally, economically, and politically unacceptable (see Section 4).

At the high end of the biological effects range, Site Condition V would allow all highly contaminated dredged material, up to and including dangerous waste classified sediments by State of Washington Standards, to be present at the unconfined, open-water disposal sites.

The "Site Condition IV" definition, described as "major adverse effects due to sediment contamination" and encompassing material up to, but not including, material defined as "dangerous waste" per State hazardous waste laws, is similar to Site Condition V in that almost all Puget Sound dredged material would be allowed for disposal at the unconfined, open-water sites (i.e., very little material contains this level of contamination).

Neither Site Conditions IV nor V were considered as acceptable biological effects conditions at the disposal sites. These conditions do not "preserve, maintain, or enhance" the integrity of the aquatic ecosystem (per the CWA). Accordingly, neither condition was carried forward for detailed planning within PSDDA. Although these site conditions would provide the least expensive options for the dredger, all the environmental risk associated with dredging and disposal would be allocated to the aquatic environment. These conditions would not be permissible under current Federal or State law.

The remaining "gray area" was divided into three different "alternative biological effects conditions for site management," each describing a different degree of adverse enviromental effects on biological resources at the sites. The various conditions differ by having increasing degrees of effects on resources at the disposal site, from "no adverse effects due to sediment chemicals" to "moderate adverse effects due to sediment chemicals" (Site Conditions I-III, table 2.3).

TABLE 2.3

ALTERNATIVE DEFINITIONS OF BIOLOGICAL EFFECTS CONDITIONS FOR MANAGEMENT OF THE UNCONFINED, OPEN-WATER DISPOSAL SITES IN PHASE I AREA

Site Condition 0: No Chemically-Related Effects on Biological Resources Due to the Absence of Measurable Chemicals of Concern.

> Onsite sediments do not contain chemicals at concentrations above analytical detection limits.

Site Condition I: No Adverse Effects on Biological Resources Due to Sediment Chemicals

> No species will be affected due to sediment chemicals within the site in the short (acute) or long (chronic) term.

Site Condition II: Minor Adverse Effects on Biological Resources Due to Sediment Chemicals

> Some species may be affected within the site from long-term exposure to sediment chemicals (only sublethal effects are anticipated).

Site Condition III: Moderate Adverse Effects on Biological Resources Due to Sediment Chemicals

> Many species may be affected within the site from both short-term and long-term exposure to sediment chemicals (both lethal and sublethal effects are possible).

Site Condition IV: Major Adverse Effects on Biological Resources Due to Sediment Chemicals

> Most species within the site may be affected by even short-term exposure to sediment chemicals (with substantial lethal effects likely). (This level includes onsite sediment chemical concentrations up to, but not including, "Dangerous Waste" material per State hazardous waste laws.)

Site Condition V: Severe Adverse Effects on Biological Resources Due to Highly Contaminated Sediments

> All dredged material, including "Dangerous Waste" material, could be discharged at unconfined, open-water disposal sites. Species onsite are likely to experience severe lethal effects due to short-term exposure to material at this level.

Site Condition I (no adverse chemical effects on biological resources), Site Condition II (minor adverse chemical effects), and Site Condition III (moderate adverse chemical effects) all define site conditions which, depending upon interpretation, could comply with the Section 404(b)(1) Guidelines. As a matter of comparison, each of these options were carried forward for detailed investigation.

State water quality standards provide that for all classes of State waters, toxic or deleterious material concentrations shall be below those which cause acute or chronic conditions to the aquatic biota. However, dilution zones can be established pursuant to the regulation, but the zones shall be restricted in area so far as practicable with application of reasonably available technology, and acute conditions within the zone are not to be allowed. Site Condition I meets State standards without a dilution zone. Site Condition II meets State standards with application of a dilution zone pursuant to the regulations. Site Condition III cannot meet State Water Quality Standards, but has been carried forward as an additional alternative for comparison of environmental and economic impacts.

b. Single Versus Multiple Site Management Conditions. Siting investigations for the Phase I area support using the same site condition for each site. The proposed sites are very similar in physical characteristics (low energy areas, deep water, and generally depositional in nature) and biological resources (soft-bottom communities, with crab and/or shrimp present in the bay, as well as bottomfish and salmon), and do not appear to warrant different management strategies.

A reason for considering multiple site conditions is that the range and distribution of dredged material chemicals and chemical concentrations varies from area to area. Selection of a single site condition with relatively low effects potential, could conceivably result in an entire geographical area not being permitted to use the unconfined, open-water disposal option. This could result in significant adverse economic effects to that area. Or, if the effects condition is set relatively high, another area may suffer significant damage to their aquatic environment, resulting in high costs for remedial action incurred by the public or site users. In other words, the definition of an acceptable site condition is recognizably affected by the economic consequences to, and social perspective of, the affected publics. A single management approach for the Sound's sites could compromise the diversity of situations and local perspectives that exists throughout the area. However, when sites have different management conditions, sites with more lenient requirements will likely receive material that cannot go to other sites, from other areas of the Sound. This results in the perception that "one community is receiving the wastes of another," a socially and politically difficult situation to manage.

A single biological effects condition for management of the central Puget Sound sites recognizes the similarity among the sites of environmental conditions and that all are a part of a common water body and ecosystem. It also recognizes that the definition of acceptability somewhat transcends local

economic and/or environmental considerations. Given limited scientific knowledge of long-term effects of chemicals, and the continued proximity of marine organisms to the sites, "fine-tuned" management of different biological effects conditions at the individual sites would be difficult. Therefore, the "one site condition" approach is considered to be the most appropriate for the Phase I area of the Sound.

c. Identification of the Selected Site Management Condition. Identification of the selected site condition for the Phase I area disposal sites is based on an assessment of the key consequences of the different conditions:

- o The volume of dredged material that could be found acceptable for unconfined, open-water disposal (not requiring other disposal methods) increases with higher (I to III) site management conditions.

- o Potential adverse effects to the biological and human resources at the Phase I disposal sites increase with higher site conditions.

- o Potential adverse effects to the biological and human resources at land and shore sites (used for disposal of material unacceptable for unconfined, open-water disposal) decrease with higher site conditions.

- o Since unconfined, open-water disposal is the least expensive of the disposal methods, the cost of dredging and disposal decreases with higher site conditions.

Three primary disposal methods are available for dredged material that is unacceptable for unconfined, open-water disposal, including confined aquatic disposal (CAD, capping of unacceptable dredged material deposited in water with acceptable material), disposal in nearshore areas, and disposal in upland areas. However, the primary environmental consideration of the site conditions selection is related to the tradeoffs between disposal in water versus disposal at nearshore and land sites. Selection of a site condition allowing the least amount of material to be placed at unconfined, open-water disposal sites would place most of the environmental and health risk associated with the chemical contamination at nearshore and upland sites. Conversely, selection of a condition that allows most of the dredged material to be discharged in water would place most of the environmental risk at the unconfined, open-water sites.

While any of the Site Conditions (I to III) can potentially be established and managed at the identified unconfined, open-water disposal sites, the quantities of material requiring other disposal methods varies significantly among these levels. Therefore, risks to water quality, fisheries, and benthic resources, which increase as the site condition increases, must be weighed relative to effects to land resources such as ground water, air quality, and land availability, which would decrease as the site condition increases.

Historically, the most prevalent and least expensive disposal option has been nearshore disposal. And though each of the disposal methods has its own

environmental risks and effects, nearshore disposal is of greatest concern to Puget Sound aquatic resources, primarily due to significant past loss of important habitat values for fish and other species via direct burial by filling for creation of uplands (PSWQA, 1986). Additionally, the active intertidal zone can present concerns in ensuring that any sediment chemicals do not leach back into surface waters (Lee, et al., 1986). And it is the nearshore environment that has received the most significant degree of past disturbance and effects. The limited availability of upland disposal sites places further pressure on nearshore areas for disposal of unsuitable material.

In addition to environmental considerations, the cost implications of the selected biological effects site condition are also substantial. In going from Site Condition III (the least costly) to Site Condition I (the most costly), dredging and disposal costs could increase by about 80 percent for the Phase I area.

Detailed assessment of the environmental consequences of the different site conditions at each of the selected sites is provided in section 4 of the FEIS. As a single site condition is proposed for the Phase I area, a summary regional analysis of the consequences of site management is also provided in section 5 of the FEIS.

Site Condition II was chosen as the appropriate biological effects condition for management of the unconfined, open-water disposal sites in the Phase I area based on a review of the environmental and economic consequences of the different site conditions, including assessment of land and shore environmental effects and cost implications to navigation dredging.

The selected site condition would allow sublethal effects within the site that might develop only after long-term exposure. The dredged material that might produce this condition at the disposal site would be expected to cause more significant toxic response to the sensitive test species in the laboratory. The laboratory tends to overstate field efforts.

d. Relation of Selected Site Condition to Dredged Material Evaluation Procedures. Dredged material evaluation procedures (sampling requirements, chemical and biological tests, and disposal guidelines), promulgated pursuant to the CWA authorities of the Corps, EPA, and Ecology are used as the primary means of ensuring that the preferred biological effects site management condition is not violated. The evaluation procedures can assist regulatory agencies in assessing whether disposal of a dredged material from a given project would result in unacceptable adverse impacts to the water column or benthic environment and, as such, would or would not be compatible with the preferred disposal site condition. It is important to note that the alternative site conditions cannot be translated to "types of dredged material" (i.e., there is no "site condition II material"). Rather, the alternative conditions represent different dividing lines between site effects that are "acceptable" and those that are not. A mix of dredged material will be discharged on site, but the site will be managed consistent with the defined

site management condition. Because only acceptable sediments will be discharged at the disposal sites, the aggregate condition of each site is expected to be substantially better than allowed under the selected management condition (site condition II).

The dredged material evaluation procedures must be continually reviewed and periodically updated to incorporate the best available scientific knowledge and information concerning potential adverse effects of sediment chemicals on biological resources. This must be done to ensure that the most appropriate tests and test interpretation guidelines are used in dredged material evaluation. Disposal site environmental monitoring is expected to be a key factor in these reviews and consideraion of proposed changes to the evaluation procedures. While the evaluation procedures will necessarily change, the selected site condition is expected to remain the site management objective in the Phase I area.

Detailed description of the PSDDA dredged material evaluations is contained in EPTA.

2.05 Final Alternatives.

a. Combinations of Disposal Sites and Alternative Biological Effects Site Conditions. In assessing the environmental consequences of the PSDDA program, it is necessary to consider the combined effects of different biological effects conditions at specific disposal sites. The possible combinations of the different sites and site conditions are numerous: nine in Port Gardner and six each in Commencement and Elliott Bays (21 combinations in total). In providing a detailed assessment of environmental consequences for a reasonable number of possible alternatives, those combinations containing both a nonpreferred site and a nonpreferred site condition were not considered further by PSDDA. The final alternatives (table 2.4), including the no action alternative, describe the range of potential environmental effects represented by all possible combinations. The table briefly describes the consequences of each of the final alternatives for purposes of overview comparisons relative to major issues. Detailed discussion of these issues is contained in section 4 of the FEIS.

Given the similarity of the disposal sites, environmental impact is generally more dependent on the site management condition rather than the disposal site location. All potential sites have relatively low habitat values; disposal at either of the two or three sites present near each major dredging area will cause little significant difference in overall environmental impact. On the other hand, different site conditions defining material that is suitable at the unconfined, open-water disposal sites will have significantly different environmental consequences. The environmental consequences of the selection of a site condition for the Phase I area are addressed in sections 4 and 5 of the FEIS.

b. Environmental Monitoring and Permit Compliance Inspections. Environmental monitoring and permit compliance inspections, also part of disposal site management, are described in the MPR and the Management Plans Technical Appendix (MPTA).

TABLE 2.4

COMPARISON OF FINAL ALTERNATIVES

Alternative	1. HABITAT LOSS a. Aquatic/Subtidal (acres)	b. Land/Shore (acres)
Commencement Bay:		
Site 1, Site Condition I	310	96
Site 1, Site Condition II *	310	29
Site 2, Site Condition II	310	29
Site 1, Site Condition III	310	5
No Action (PSIC)	N/D 1/	230
Elliott Bay:		
Site 1, Site Condition I	415	274
Site 1, Site Condition II *	415	266
Site 2, Site Condition II	480	266
Site 1, Site Condition III	415	162
No Action (PSIC)	N/D 1/	569
Port Gardner:		
Site 1, Site Condition I	318	101
Site 1, Site Condition II *	318	10
Site 2, Site Condition II	375	10
Site 3, Site Condition II	318	10
Site 1, Site Condition III	318	0
No Action (PSIC)	N/D 1/	264
Total for all Sites:		
Site Condition I	1,043	471
Site Condition II	1,043	305
Site Condition III	1,043	167
No Action	N/D 1/	1,063

*Selected alternative

1/N/D: not determined. Some loss of aquatic, subtidal habitat is expected for disposal of material that meets the Puget Sound Interim Criteria, via beneficial use projects or projects that are able to obtain necessary permits for unconfined, open-water disposal on a case-by-case basis.

TABLE 2.4 (con.)

Alternative	2. FAUNA a. Aquatic/Subtidal	b. Land/Shore
No Action	Minor loss of benthic invertebrates or displacement of fish or shellfish, and no chemical effects.	Major loss of land invertebrates and displacement of land/shore species. Major chemical risks at sites.
Commencement Bay: Site 1, Site Condition I	Minor loss of benthic invertebrates and displacement of fish and shellfish. No chemical effects on site.	Major loss of land invertebrates and displacement of land/shore species. Major chemical risks at sites.
Site 1, Site Condition II	Minor loss of benthic invertebrates and displacement of fish and shellfish. Minor, sublethal chemical effects within site.	Moderate loss of land invertebrates and displacement of land/shore species. Moderate chemical risks at sites.
Site 2, Site Condition II	Minor loss of benthic invertebrates and displacement of fish and shellfish. Minor, sublethal chemical effects within site.	Moderate loss of land invertebrates and displacement of land/shore species. Moderate chemical risks at sites.
Site 1, Site Condition III	Minor loss of benthic invertebrates and displacement of fish and shellfish. Moderate, acute chemical effects within site.	Minor loss of land invertebrates and displacement of land/shore species. Minor chemical risks at sites.

TABLE 2.4 (con.)

Alternative	2. FAUNA a. Aquatic/Subtidal	b. Land/Shore
Elliott Bay		
Site 1, Site Condition I	Minor loss of benthic invertebrates and displacement of fish and shellfish. No chemical effects on site.	Major loss of land invertebrates and displacement of land/shore species. Major chemical risks at sites.
Site 1, Site Condition II	Minor loss of benthic invertebrates and displacement of fish and shellfish. Minor, sublethal chemical effects within site. Displacement/loss of shrimp from site.	Moderate loss of land invertebrates and displacement of land/shore species. Moderate chemical risks at sites.
Site 2, Site Condition II	Minor loss of benthic invertebrates and displacement of fish and shellfish. Minor, sublethal chemical effects within site.	Moderate loss of land invertebrates and displacement of land/shore species. Moderate chemical risks at sites.
Site 1, Site Condition III	Minor loss of benthic invertebrates and displacement of fish and shellfish. Moderate, acute chemical effects within site.	Minor loss of land invertebrates and displacement of land/shore species. Minor chemical risks at sites.
Port Gardner:		
Site 1, Site Condition I	Minor loss of benthic invertebrates and displacement of fish and shellfish. No chemical effects on site.	Major loss of land invertebrates and displacement of land/shore species. Major chemical risks at sites.

TABLE 2.4 (con.)

Alternative	2. FAUNA a. Aquatic/Subtidal	2. FAUNA b. Land/Shore
Site 1, Site Condition II	Minor loss of benthic invertebrates and displacement of fish and shellfish. Minor, sublethal chemical effects within site.	Moderate loss of land invertebrates and displacement of land/shore species. Moderate chemical risks at sites.
Site 2, Site Condition II	Minor loss of benthic invertebrates and displacement of fish and shellfish. Minor, sublethal chemical effects within site. Burial/displacement of crabs from site.	Moderate loss of land invertebrates and displacement of land/shore species. Moderate chemical risks at sites.
Site 3, Site Condition II	Minor loss of benthic invertebrates and displacement of fish and shellfish. Minor, sublethal chemical effects within sites.	Moderate loss of land invertebrates and displacement of land/shore species. Moderate chemical risks at sites.
Site 1, Site Condition III	Minor loss of benthic invertebrates and displacement of fish and shellfish. Moderate, acute chemical effects within site.	No loss of land invertebrates and displacement of land/shore species. No chemical risks at sites.

TABLE 2.4 (con.)

Alternative	3. WATER AND SEDIMENT QUALITY a. Aquatic/Subtidal	b. Land/Shore
No Action	No adverse effects to water quality or sediment quality.	Major chemical risks to ground water and shoreline water.
Commencement Bay: Site 1, Site Condition I	Short-term water quality effects. No change to existing sediment quality.	Major chemical risks to ground water and shoreline water.
Site 1, Site Condition II	Short-term water quality effects. Minor adverse effects to sediment quality within site.	Moderate chemical risks to ground water and shoreline water.
Site 2, Site Condition II	Short-term water quality effects. Minor adverse effects to sediment quality within site. More dispersive site.	Moderate chemical risks to ground water and shoreline water.
Site 1, Site Condition III	Short-term water quality effects. Moderate, adverse effects to sediment quality on site.	Minor chemical risks to ground water and shoreline water.
Elliott Bay: Site 1, Site Condition I	Short-term water quality effects. Improvement of existing sediment quality.	Major chemical risks to ground water and shoreline water.
Site 1, Site Condition II	Short-term water quality effects. No change in existing sediment quality.	Moderate chemical risks to ground water and shoreline water.

TABLE 2.4 (con.)

Alternative	3. WATER AND SEDIMENT QUALITY a. Aquatic/Subtidal	b. Land/Shore
Site 2, Site Condition II	Short-term water quality effects. No change in existing sediment quality. More dispersive site.	Moderate chemical risks to ground water and shoreline water.
Site 1, Site Condition III	Short-term water quality effects. Moderate, adverse effects to sediment quality on site.	Minor chemical risks to ground water and shoreline water.
Port Gardner:		
Site 1, Site Condition I	Short-term water quality effects. No change to existing sediment quality.	Major chemical risks to ground water and shoreline water.
Site 1, Site Condition II	Short-term water quality effects. Minor adverse effects to sediment quality within site.	Moderate chemical risks to ground water and shoreline water.
Site 2, Site Condition II	Short-term water quality effects. Minor adverse effects to sediment quality within site. More dispersive site. Closer to resources. Overlaps proposed Navy site.	Moderate chemical risks to ground water and shoreline water.
Site 3, Site Condition II	Short-term water quality effects. Minor adverse effects to sediment quality within site. More distant site.	Moderate chemical risks to ground water and shoreline water.

TABLE 2.4 (con.)

Alternative	3. WATER AND SEDIMENT QUALITY a. Aquatic/Subtidal	b. Land/Shore
Site 1, Site Condition III	Short-term water quality effects. Moderate, adverse effects to sediment quality on site.	No chemical risks to ground water and shoreline water.

TABLE 2.4 (con.)

Alternative	4. NAVIGATION DREDGING 1/ Volumes Estimated for UCOW (2/) Disposal (c.y.)	Volumes Estimated for Confined Disposal (c.y.)
Commencement Bay:		
Site 1, Site Condition I	1,348,000	2,581,000
Site 1, Site Condition II	3,160,000	769,000
Site 2, Site Condition II	3,160,000	769,000
Site 1, Site Condition III	3,776,000	153,000
No Action (PSIC)	225,000	3,704,000
Elliott Bay:		
Site 1, Site Condition I	3,113,000	7,412,000
Site 1, Site Condition II	3,374,000	7,151,000
Site 2, Site Condition II	3,374,000	7,151,000
Site 1, Site Condition III	6,162,000	4,363,000
No Action (PSIC)	1,350,000	9,175,000
Port Gardner: 3/		
Site 1, Site Condition I	2,212,000	2,731,000
Site 1, Site Condition II	4,684,000	259,000
Site 2, Site Condition II	4,684,000	259,000
Site 3, Site Condition II	4,684,000	259,000
Site 1, Site Condition III	4,943,000	0
No Action (PSIC)	675,000	4,268,000
Total for all Sites:		
Site Condition I	6,673,000	12,724,000
Site Condition II	11,218,000	8,179,000
Site Condition III	14,881,000	4,516,000
No Action (PSIC)	2,250,000	17,147,000

1/Estimated volume of future dredged material that could be discharged at the selected sites (once permitted) such that the site management condition would not be exceeded.

2/Unconfined, open water.

3/Navy Homeport project is not included in these volumes, as dredged material from this project will not be discharged at the PSDDA site.

TABLE 2.4 (con.)

	5. COST OF DREDGING AND DISPOSAL 1/ 3/
Commencement Bay:	
Site 1, Site Condition I	$48,344,000
Site 1, Site Condition II	23,398,000
Site 2, Site Condition II	23,398,000
Site 1, Site Condition III	15,465,000
No Action (PSIC)	64,098,000
Elliott Bay:	
Site 1, Site Condition I	165,405,000
Site 1, Site Condition II	161,556,000
Site 2, Site Condition II	161,556,000
Site 1, Site Condition III	118,578,000
No Action (PSIC)	190,795,000
Port Gardner:	
Site 1, Site Condition I	53,930,000
Site 1, Site Condition II	19,104,000
Site 2, Site Condition II	19,104,000
Site 3, Site Condition II	19,104,000
Site 1, Site Condition III	16,029,000
No Action (PSIC)	76,194,000
Total for all Sites: 2/	
Site Condition I	267,679,000
Site Condition II	204,058,000
Site Condition III	150,072,000
No Action	330,762,000

1/Assumptions and derivation of cost estimates are provided in EPTA.

2/Costs do not vary between the preferred and alternative sites for each of the three embayments.

3/See table 4.7 in Section 4 for cost data presented on an average cost per cubic yard basis for each disposal site under the three site management conditions evaluated.

c. Advance Federal Identification of Sites. Pursuant to 40 CFR 230.80, the Corps and EPA have identified the sites specified through the PSDDA process as being generally suitable for future disposal of dredged material. This determination is based on technical information developed through the PSDDA studies and presented in the Phase I FEIS. The final determination of 230.80 site suitability is attached to the FEIS (exhibit B).

d. Native American Fishing.

(1) Introduction. The rights of Native American tribes to fish at all "usual and accustomed grounds and stations" in Puget Sound and the Strait of Juan de Fuca were established by treaties negotiated in the 1850's. Isaac Stevens (then Governor and Indian Agent of the Washington Territory) negotiated five treaties with Indian tribes of Western Washington:

Treaty of Medicine Creek
Treaty of Point Elliott
Treaty with the Quinault
Treaty of Point No Point
Treaty of Neah Bay

The first three treaties in the above list include the provision: "The right of taking fish at usual and accustomed grounds and stations is further secured to said Indians in common with all citizens of the Territory." The Point No Point and Neah Bay treaties have identical language, except that they provide for fishing in common with "citizens of the United States."

Federal agencies have a trustee responsibility to exercise when making decisions which may affect treaty fishing rights.

There are 14 Puget Sound Treaty Tribes that are recognized as sovereign tribal entities governments with fishing rights at all "usual and accustomed grounds and stations" in Puget Sound and the Strait of Juan de Fuca [as defined in United States v. Washington (384 F. Supp. 312, (DCWA 1974)) and United States v. Washington, 459#F. Supp. 1020 (DCWA 1978)] (see table 2.5). Under these decisions, the treaty tribes are assured the opportunity to catch up to 50 percent of the harvestable portions of salmon and steelhead runs passing through or originating from usual and accustomed fishing grounds. In addition, fish are harvested for ceremonial and subsistence purposes within these areas.

Presently, by agreement, regulation of fishery resources, which are subject to treaty rights, including resource conservation actions, is accomplished through joint management by the State and treaty tribes. Puget Sound is subject to treaty fishing, including each of the potential open-water dredged material disposal sites identified and discussed in this DEIS. The PSDDA agencies recognize treaty fishing rights and formulated the PSDDA proposed management plan to avoid significant adverse effects on the ability of the Indian tribes to take fish or on the fishery resource.

TABLE 2.5

TRIBES POSSESSING FISHING RIGHTS
IN THE PSDDA PHASE I AREA (CENTRAL PUGET SOUND)

The following tribes possess adjudicated fishing rights in or around the alternative disposal sites studied by PSDDA in central Puget Sound:

Tulalip Tribes
Muckleshoot Tribe
Puyallup Tribe
Suquamish Tribe
Yakima Tribe
Lummi Tribe
Swinomish Tribe

The following tribes are not formally recognized by the Federal Government at this time for the purpose of receiving services from the U.S. Bureau of Indian Affairs, but may additionally possess fishing rights to be recognized in the future:

Duwamish Tribe (Duwamish River and Lake Washington)
Samish Tribe (area unknown)
Skykomish Tribe (area unknown)
Snohomish Tribe (area unknown)
Snoqualmie Tribe (area unknown)
Stillicum Tribe (area unknown)

To ensure tribal input, coordination was maintained throughout PSDDA with Indian tribes. Participation in work group meetings, direct contacts with individual tribes and special meetings with tribal representatives as well as exchange of correspondence were used to identify tribal concerns that were addressed by the study team and in the study documents.

The PSDDA agencies have taken a variety of steps to minimize the potential for open-water disposal of dredged material to affect treaty fishing. Also further steps have been specified which would be taken on a project by project basis. These steps are summarized below, and are discussed in more detail in other sections of the DEIS as noted.

(2) Consideration of Treaty Fishing Rights. Several steps were taken during the PSDDA site identification process to avoid the potential for significant adverse impacts on the treaty fishing rights.

As part of the site selection process, an attempt was made to identify the high intensity fishing areas and areas of significant habitat. ZSF's were defined, to the extent possible, by avoiding these areas and areas where human use activities presented potential conflicts (see section 2). Also, the ZSF's were sought in low energy (nondispersive) environments to facilitate disposal site monitoring and to avoid offsite impacts. The ZSF siting studies identified where the least direct impact to resources - via direct exposure and offsite sediment transport - would exist. Within ZSF's possible disposal site locations were chosen which best avoid fishing and high quality habitat areas (e.g., via food web studies).

Having identified the areas which best avoid direct impacts to marine resources, the quality of dredged material allowable at these sites further determines the level of impacts which may occur. Any of the alternative site management conditions (I-III) can be managed at the identified unconfined, open-water disposal sites without unacceptable adverse effects. However, the quantities of material requiring confined disposal varies greatly among these levels. To the extent that confined disposal may result in further losses of nearshore ares, further impacts to fishing could occur.

If Site Condition I had been chosen as the management alternative for the open-water disposal sites, greater quantities of dredged material would require confined disposal than with Site Condition II. This would result in significantly more proposals to fill nearshore areas than with Site Condition II. Similarly, Site Condition II results in greater volumes of material requiring confined disposal than Site Condition III.

Because specific sites for confined disposal were not identified, it is impossible to accurately evaluate the extent of nearshore impacts that would occur for a given site condition. However, it is judged that, overall, confined disposal results in greater environmental impacts than disposal at the PSDDA sites. This judgement is based on the success of the disposal site identification process in specifying potential sites that are well buffered from resources of concern and that are themselves of relatively low habitat value.

Primarily because of the site selection process followed by PSDDA, there is little potential for unacceptable adverse effects to occur to Puget Sound to tribal fishing rights. However, indirect effects due to potential vessel traffic conflicts could not be entirely eliminated by the siting process. Because disposal site areas will continue to be subject to tribal fishing, further project specific actions are necessay.

The following has been identified as apropriate project specific action to resolve any conflict that dredging vessel traffic may have on tribal fishing operations.

> Permitting authorities will allow disposal to occur when there is no treaty fishing activity occurring at the disposal site. This will be accomplished via the DNR disposal site use permit and the Section 404 permit process. During processing of individual Section 404 applications, any potential conflict between treaty fishing and vessel traffic will be addressed prior to disposal. Conditioning of permits such that disposal will be consistent with tribal fishing operations may be appropriate as may be denial of permit applications where necessary.

In following this permitting process, disposal-related vessel traffic and fishing gear conflicts with tribal fishing operations should not occur. Violations of permit conditions, including permit conditions based on protecting treaty rights, are enforceable under Federal law.

SECTION 3. AFFECTED ENVIRONMENT

3.01 Regional Setting. The Phase I study area includes central Puget Sound, extending north from the Narrows Bridge at Tacoma to the top of the Kitsap Peninsula (Foulweather Bluff) near the entrance to Hood Canal and across Admiralty Inlet to Whidbey Island (Double Bluff). It extends up the east side of Whidbey Island, including Port Gardner, and Saratoga Passage to a point near the community of Camano (figure 3.1).

a. Physical Environment.

(1) Geology. The three major dredging areas of Phase I are located within the Puget Sound Lowland Physiographic province. The lowland is a north-south trending trough which is characterized by a thick sequence of glacial sediment with a fairly active seismic history. Most of the lowlands lie within 500 feet of present sea level and consist of elongated hills of gentle to moderate relief. Lakes are common and many rivers and streams drain the area.

The glacial sediments, which mantle most of the Puget Sound lowlands, are the result of several ice advances which have occurred within the last 50,000 years. During the roughly 11,000 to 15,000 years since the last glaciation, erosion and mass wasting processes have been modifying the land's surface. Erosion along shorelines and rivers has resulted in steep bluffs and landslides. Much of this eroded material has been deposited within lakes, and river valleys, and at deltas where the rivers empty into Puget Sound. Manmade changes in the form of cuts and fills have occurred within the last 120 to 140 years. Based on geophysical soundings and deep test borings, it appears that the bedrock underlying the glacial sediments in the Puget Trough consists of several large tectonically active blocks which have or are currently moving relative to one another. This movement is to be believed responsible for the many earthquakes which occur within the area. Recent evidence suggests that major earthquakes to magnitude 7.8 on the Richter scale are possible within the Puget Sound basin.

Sediments are largely maintained in the main basin due to a prominent "sill" located between Admiralty Head and Port Townsend. The central basin is generally over 600 feet deep, whereas the shallow "sill" is only 125 feet deep, thereby acting as a natural barrier to the escape of water and particles from the central basin of Puget Sound to the Strait of Juan de Fuca and the Pacific Ocean (PSWQA, 1986 (Issue Paper: Contaminated Sediments and Dredging)).

(2) Water Quality. Water quality in the main basin of Puget Sound is generally classified as "extraordinary" (Class AA) according to 1984 Ecology standards. Much of the present concern about water quality is focused on the potential for degrading water quality in currently relatively clean areas of the Sound and on highly industrialized embayments such as Commencement Bay, Elliott Bay, and Port Gardner, where the historic practice of discharging wastes into nearshore waters has produced significant pollution related

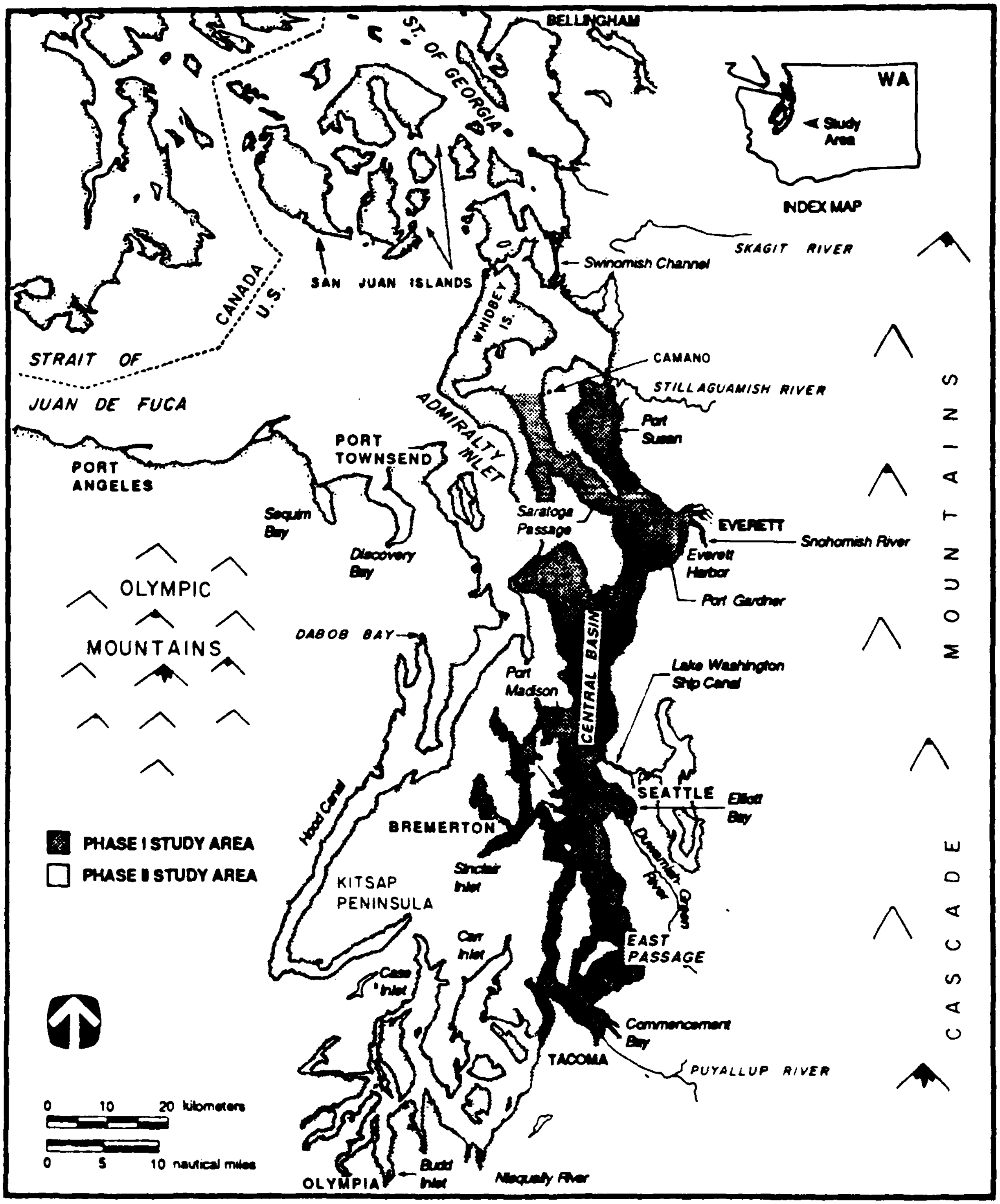


Figure 3.1 Puget Sound, Washington
Puget Sound Dredged Disposal Analysis Study Area

impacts. Contaminant concerns have surfaced in recent years and have been the focus of ongoing investigations and analysis by the Puget Sound Water Quality Authority which has led to the adoption of a Puget Sound Water Quality Management Plan (PSWQA, 1986). The reader is referred to the 1986 PSWQA "State of the Sound Report" for a comprehensive overview of water quality conditions in Puget Sound and the 1987 Puget Sound Water Quality Management Plan for a detailed discussion of pollution control activities. The following summary is extracted from this report.

Historically, Puget Sound has been impacted by discharges of conventional pollutants (i.e., high BOD, pathogens, and nutrients) and toxic chemical substances, although most of the point source discharges are now controlled through the NPDES permit program. Although controls on large discharges of untreated sewage and mill effluents have been successful at reducing high BOD's and improving water quality, isolated fish kills still occur in localized areas of the Sound due to natural (i.e., algal blooms) and anthropogenic sources. Nutrients are generally not a problem in the marine waters of the central Puget Sound basin.

Potentially harmful chemicals entering Puget Sound from a variety of point and nonpoint sources bind to particles in the water which eventually settle to the bottom. As a result, sediments in some portions of the Sound are currently contaminated with potentially harmful and persistent chemicals. Chemicals of concern have been identified in sediments from all three Phase I urban embayments. Severe chemical contamination of Puget Sound from multiple sources, as measured in sediments and animal tissues, appears to be patchy in distribution and generally confined close to the sources (PSWQA, 1986). Of the thousands of chemicals known or suspected to exist in the environment, only a relatively small number are routinely measured. They typically have been identified as (1) potentially affecting human health or marine life; (2) historically documented in the Sound in substantial concentrations; (3) persistent in toxic form; and (4) have potential for food-web transfer (PSWQA, 1986). Table 3.1 summarizes the status of selected toxic chemicals of concern in the Puget Sound basin in water, sediments, and tissue.

Concentrations of trace metals and organic chemicals of concern from 100 to 10,000 times greater than underlying water have been observed in the thin (0.002 inches: 0.05 mm) layer at the seawater surface called the sea surface microlayer (Word et al., 1986; Hardy, 1986). High levels of chemicals have been related to the presence of dissolved organic matter concentrated in this layer in a complex matrix of natural and synthetic substances floating on the surface like oil. Atmospheric inputs as well as oil and grease and metals in municipal sewage, and industrial effluent are the primary input sources to the microlayer. Floatable substances in dredged material also have been suggested as a potential input source to the sea surface microlayer (Word et al., 1986; Hardy, 1986).

Site specific discussions on water quality conditions are addressed later in this section for each of the three urban embayments where a disposal site is being considered.

TABLE 3.1

SELECTED CONTAMINANT DISTRIBUTIONS
IN THE PUGET SOUND BASIN (After PSWQA, 1986) 1/

	Water 2/	Sediment	Tissue
PAH's	Detected at very low concentrations (.01 ppb) in waters of Puget Sound central basin. Mostly associated with particulates suspended in water.	Elevated concentrations (from 10x to 420x reference) in industrialized urban areas. Eagle Harbor has highest elevation measured.	Mainly in invertebrates; some in fish livers; rarely in fish muscle tissue. Elevated levels in invertebrates from Eagle Harbor, Mukilteo ferry dock area.
PCB's	Detected at very low concentrations (.001 to .01 ppb) in waters of Puget Sound central basin. Mostly associated with particulates suspended in water.	Elevated concentrations (from 20x to 130x reference) in industrialized urban areas with exception of Bellingham Bay.	Found in nearly all organisms from nearly all areas; highest levels in fatty tissues of marine mammals with long lifespans (e.g., harbor seals from southern Puget Sound).
Copper	Detected at very low concentrations (.1 to 1 ppb) in waters of Puget Sound central basin.	Elevated concentrations (from 10x to 370x reference) in Elliott Bay, Hylebos Waterway, Everett Harbor, Bellingham Bay, Eagle Harbor, and Sinclair Inlet. Highest elevation along Ruston-Point Defiance shoreline, Commencement Bay.	Copper can accumulate in tissues of bivalve mollusks, crustacea, fish livers, and birds in industrialized urban areas. Copper is a natural component of the blood of crabs and snails and some other invertebrates. Significant accumulation of copper in fish muscle tissue from several areas of Commencement Bay.
Lead	Detected at very low concentrations (1 to 10 ppb) in waters of Puget Sound Central basin.	Elevated concentrations (from 10x to 110x reference) in Elliott Bay and Sinclair Inlet. Highest elevation along Ruston-Point Defiance shoreline.	Lead can accumulate in tissues of bivalve mollusks, crustacea, fish livers, and birds in industrialized urban areas. Lead does not generally accumulate at high levels in fish tissue.
Zinc	Detected at very low concentrations (1 to 10 ppb) in waters of Puget Sound central basin.	Elevated concentrations (from 10x to 43x reference) in Elliott Bay, Duwamish River, Ruston-Point Defiance (43x reference), Everett Harbor, Sinclair Inlet.	Zinc can accumulate in tissues of bivalve mollusks, crustacea, fish livers, and birds in industrialized urban areas. Zinc does not generally accumulate at high levels in fish muscle tissue.
Mercury	Detected at very low concentrations (less than .001 ppb) in waters of Puget Sound central basin.	Elevated concentrations (from 10x to 170x reference) in Elliott Bay, Ruston-Point Defiance (170x reference), Bellingham Bay, and Sinclair Inlet.	Historically high concentrations in mussels in Bellingham Bay. Mercury can accumulate in tissues of bivalve mollusks, crustacea, fish livers, and birds in industrialized urban areas. Mercury has not been found to accumulate at high levels in fish muscle tissue from Puget Sound, but does in fatty tissues of long-lived marine mammals (probably as methyl mercury).
Arsenic	Detected very low concentrations (1 to 10 ppb) in waters of Puget Sound central basin.	Elevated concentrations (from 10x to 620x reference) in Hylebos Waterway and Ruston-Point Defiance (620x reference) shoreline.	Arsenic levels in invertebrates, fish, and birds from areas containing contaminated sediments are similar to those in reference areas. A naturally high level of arsenic in seawater in the Northwest Pacific and Puget Sound is a major source of arsenic in organisms.

1/These contaminants are selected because they have been the most studied. Many other compounds are known to be present in harmful amounts.
2/From Romberg, et al., 1984.

(3) Currents and Sediment Transport. Although tidal action is a principal driving force of the dynamic oceanographic processes occurring in Puget Sound, the basin does receive a significant volume of freshwater each year from river discharge, amounting to approximately 20 percent of its total volume. Strong tidal currents and turbulence mix the freshwater and seawater. Inflowing riverwater escapes to the ocean and, as a result of mixing, also carries with it about 9 to 10 times its volume of seawater. To compensate for the loss of seawater, there is an inflow of more saline water from the Strait of Juan de Fuca. Because the mixed water is of lower salinity, and therefore of lower density, a net outflow occurs near the surface and a net inflow at depth (DSSTA). The topography of Puget Sound produces complex current patterns. However, in general the swiftest currents flow near the channel centers, and weaker currents occur near the shore, and at the heads of most bays.

The rivers that flow into Puget Sound discharge about 17.5 million cubic yards (c.y.) of sediment annually (Downing, 1983)1/. A large portion of this material is fine enough to remain suspended, and is carried out of the Sound. The rest is deposited at the river deltas and in quiet areas such as bays and inlets.

Heavier particles settling out of the water column form the bottom sediments. Lighter sediments comprised of smaller particles may be suspended in the water column just above the bottom and form what is called a benthic nephloid layer (PSWQA, 1986). The nepheloid layer moves around with the bottom currents thereby transporting and redistributing sediments throughout the deep basin of Puget Sound.

(4) Marine and Estuarine Sediments. Sediment quality throughout the central basin of Puget Sound and in the three Phase I study areas has been well documented (Dames and Moore, 1981; Romberg et al., 1984; Tetra Tech, 1985; Stober and Chew, 1984; Chapman, et al., 1984; PSWQA, 1986; U.S. Navy Homeport, Everett, WA FEIS, 1985; U.S. Navy Homeport, Everett, WA EISS (Corps), 1986; etc.). Conclusions emerging from these studies indicate that much of present elevated chemical concentrations in sediments are associated with areas of intensive human activity, whereas the deep central basin and embayments receiving little human use have relatively low levels of chemicals of concern, although they show significant elevations relative to historic 1840 levels measured in core samples (PSWQA, 1986). Table 3.1 summarizes the status of selected chemicals of concern found in Puget Sound basin sediments.

Site specific discussions of sediment quality conditions are addressed later in this section for each of the three urban embayments where a disposal site is being considered.

1/At density equivalent to dredged material.

b. Biological Environment.

(1) Benthic Communities. The following descriptions are taken from the Elliott Bay Small Craft Harbor EIS (Corps, 1987), but generally apply to benthic habitats found in the three Central Puget Sound Phase I study areas.

The highest intertidal areas are generally riprapped with larger rock or concrete rubble, and are occupied by plants and animals adapted to extensive exposure and limited immersion in water. Common animals include littorine snails and limpets. Barnacles occur only near Mean Higher High Water (MHHW) line.

The high midtidal region (between MHHW and Mean Sea Level (MSL)) has a much greater assemblage of plants and animals than areas above MHHW. Substrate diversity is high, further enhancing the diversity of the biological community. Barnacles occur on cobbles and boulders throughout this zone. Limpets and mussels are also found on larger rocks and rubble. A cover of sea lettuce (Ulva spp.) occurs on rocks and boulders in the upper part of the zone. The brown rockweed (Fucus vesiculatus), sea lettuce, and red alga (Endocladia spp.) are common in the lower portions.

The low midtidal region from about MSL to Mean Lower Low Water (MLLW) is an area of high productivity and diversity. Animals and plants attached to rock surfaces include large numbers of barnacles and mussels, frequently displaced by a dense cover of algae. Near MLLW, plant and animal cover on the cobble/boulder may exceed 70 percent. Beneath the rocks, the purple shore crab (Hemigrapsus spp.) is abundant. Also found on or beneath rocks are encrusting sponges and sea squirts (ascidians), and the green sea anemone (Anthopleura spp.). The clay pavement substrate is colonized by boring clams. Sand and mixed-fine substrates appear to be relatively barren except for scattered Macoma, heart cockles (Clinocardium nuttallii), butter clams (Saxidomus giganteus), and little neck clams.

The lowest intertidal area (MLLW to Mean Low Water (MLW)) contains many of the same species found in the subtidal habitats as well as some forms typically seen at higher areas. Plant and animal production and diversity are apparently greater than at higher elevations. Plants are a conspicuous and dominant feature. Scattered patches of eelgrass (Zostera spp.) occur up to about -1.0 feet on sand substrate. Much more common and abundant are algae species. The most abundant brown algae are Laminaria, Costaria, Alaria, and Sargassum. The bull kelp, Nereocystis, is uncommon except for the lowest levels of the intertidal zone. Green algae are dominated by Ulva and red algae are characterized by encrusting and large fleshy forms. Common larger benthic animals include sea anemones, polychaete worms, crabs and sea squirts.

Typical subtidal habitats include silt and sand, sand with coarse gravel and shell debris, and gravel/cobble/boulder beds. The first habitat type is characterized by fine to medium sand sediments. Benthic plants and animals are dominated by forms adapted to soft bottom habitats. Plants are primarily a microflora of diatoms with occasional drifting or unattached macroalgae.

Epifauna are generally uncommon. Occasional residents include sea stars, sea pens, pagurid hermit crabs, nudibranchs, and burrowing anemones. Mud shrimp (Upogebia) and ghost shrimp (Callianasa) in shallower sublittoral/littoral areas are the most common large infaunal crustacean species. Dungeness crab are abundant in many Puget Sound embayments. Pandalid shrimp support commercial fisheries in Port Susan and Port Gardner, and a limited fishery in Elliott Bay. Geoducks (Panope generosa) are present in commercial numbers in many areas in central Puget Sound. Smaller infauna include a relatively diverse and abundant community of tube dwelling polychaetes and amphipods.

Another subtidal habitat is characterized by silty-sand or small cobble/gravel material. Shell debris is dense in places and consists mainly of rock boring clam and horse clam shells. Plant forms include occasional macroalgae and scattered small patches of eelgrass. Epifauna are restricted mainly to larger rocks and wood debris. Turret shells are common on the rocks and nudibranchs are occasionally found. The coon-stripe and broken-back shrimps are common under logs and under rocky rubble. The rock crab is also seen around rocky areas. Open sandy areas are occupied by occasional sea pens. Cockles are common infauna.

A third subtidal habitat is comprised of mixed coarse material overlying sediments comprised of small gravels, sand and silt, or flat clay hard pan. Marine flora utilizing this habitat are dominated by a rich and diverse assemblage of macroalgae including bull kelp (Nereocystis), Laminaria, Costaria, Alaria, Petalonia, Fucus, Sargassum, Ulva, Codium, and a number of filamentous and blade-like red algae. Epifauna includes abundant populations of broken-back shrimp, rock crab, and kelp crab (Pugettia producta). Nudibranchs occur between and on top of the algae. Two anemones, Tealia coriacea and Metridium sp. (large white anemone) are common as are slipper shells and sea squirts. Echinoderms include several sea stars and a sea cucumber (Cucumaria). Infauna include a typical community of polychaete worms adapted to gravel/rocky bottom habitats. Common are plume worms (serpulid) and spaghetti worms.

(2) Plankton Communities. Long-term studies on phytoplankton diversity and abundances are lacking for Puget Sound (Dexter et al., 1985). Phytoplankton can become a water quality concern when present in intense blooms, although exact conditions under which blooms occur are not known. Blooms may be related to anthropogenic nutrient inputs (Dexter, et al., 1981). Bloom dynamics are described below for Elliott Bay and is used as a model for the generalized successional sequence observed in other Puget Sound embayments such as Commencement Bay, Port Gardner, and Saratoga Passage.

Temporal variations in phytoplankton abundances have been described in Elliott Bay with multiple blooms commencing in May and extending through September. A succession of species composition ensues with an initial diatom bloom followed by a dinoflagellate bloom followed by a fall diatom bloom. The spring and early summer blooms are typified by species such as Skeletonema costatum, Nitzschia spp., Chaetoceros constrictus, C. debilis, C. compressus, C. socialis, Thalassiosira aestivales and T. nordenskioldii. Mid-summer peaks are usually dominated by S. costatum, whereas late summer dinoflagellate blooms are dominated by Peridinium spp., Gynmodinium spp., and Ceratium fusus. Fall diatom blooms result in a shift back to Chaetoceros spp. and

Thalassiosira spp. Also present during the summer are the very small (i.e., 1-2 micron) nanoflagellates, which may contribute significantly to primary production. This successional pattern is likely followed to a certain extent in all the central Puget Sound embayments, although species composition and dominance hierarchies may vary accordingly.

Paralytic Shellfish Poisoning (PSP), a serious potential health threat in Puget Sound, is associated with certain "red tide" phytoplankton blooms (Dexter et al., 1985). PSP is caused by a toxin which is produced generally by species of *Gonyaulax*, a dinoflagellate. Along the Pacific Northwest coast, *Gonyaulax catenella* has been identified as the dinoflagellate responsible for producing PSP. The toxin bioaccumulates in shellfish and other organisms and can cause paralysis leading to death in humans eating tainted shellfish (Saunders, et al., 1982; and Strickland, 1983). PSP is a relatively recent concern in the main basin of Puget Sound and has been identified by the Puget Sound Estuary Program (PSEP) as an area warranting further study. Only limited data are available to assess temporal trends and occurences in the main Puget Sound basin and other areas. The threat of PSP affecting humans is controlled by DSHS through shellfish harvesting regulations and shellfish bed closures, which are publicized as necessary throughout the Puget Sound area. In recent years PSP has been spreading throughout the Sound. PSP cysts are known to occur in sediments, and cyst redistribution is suspected as one potential pathway for PSP spread.

A large number of zooplankton species are found in Elliott Bay. Numerically dominant forms include the copepods *Corycaeus* spp., *Pseudocalanus* spp., and *Microcalanus* spp., whereas biomass dominant forms are comprised of larger copepods (*Calanus* spp.), euphausids (*Euphausa pacifica*), and amphipods (e.g., *P. pacifica*).

The Elliott Bay neuston community (i.e., minute organisms floating at the seasurface and exposed to any contamination in the seasurface microlayer) is divided into bacterioneuston, zooneuston, and phytoneuston.

Regarding bacterioneuston, seasurface microlayer (upper 150 um.) populations have been shown to have different species and more individuals than in subsurface waters.

Zooneuston include bacteria, protozoa, small metazoans (less than 1 mm), large metazoans (greater than 1 mm), fish eggs, larvae, and fry. These organisms form an extremely rich layer of the sea, although they remain largely unstudied. Juvenile fish are known to actively feed on live neuston within the surface microlayer. It is likely that zooneuston resources existing in the upper surface layers of the water column are critical to the life history stages of many important Puget Sound marine organisms. Many species of commercial and ecological importance have life history stages that can be affected by microlayer contamination.

Phytoneuston genera in the surface environment are functionally distinct from the phytoplankton community in terms of species composition and standing

crop. Phytoneuston communities have higher abundances, lower diversities, and higher variations in species composition and abundance, greater absolute biomass, and more variable productivity. Phytoneuston communities, particularly those observed in nearshore environments, are frequently dominated by diatoms, dinoflagellates, blue-green algal mats (cyanophyta), and euglenoids (Word et al., 1986).

(3) Anadromous and Marine Fishes. Northwest Indians first harvested salmon thousands of years ago, and today salmon remain the most important component of the tribal and commercial and sport fisheries in Puget Sound. Estimated average annual (1974-1978) total commercial salmon catch for all five species migrating through the Strait of Juan de Fuca (including Fraser River Stocks) is 117,000 tons (PSWQA, 1986). The 1984 salmon harvest accounted for approximately 67 percent of the value of Puget Sound's commercial fisheries. Sport catches of salmon are estimated at 800 tons in the Strait of Juan de Fuca and approximately 1,600 tons in the main basin (PSWQA, 1986).

The salmon fishery is subject to stringent management measures which limit catches for all species and result in frequent closures for entire fisheries, in order to ensure adequate spawning escapement. Natural runs of spring chinook are all but extinct (PSWQA, 1986). Coho is the most abundant species in the main basin and in south Puget Sound, and is maintained almost exclusively by hatchery propagation. Populations of chinook, coho, pink, and chum salmon, as well as steelhead trout, are also supplemented artificially by hatcheries and rearing pens throughout the Sound. While hatcheries create more fish, they also interfere with the natural gene pool, which may ultimately influence the health of the salmon populations.

Spawning and rearing habitats have been adversely affected by logging operations, dam and lock construction, shoreline development, and urban runoff (PSWQA, 1986).

(4) Marine Mammals. Several species of Puget Sound's resident marine mammals likely use Commencement Bay, Elliott Bay, Port Gardner, and Saratoga Passage for feeding or resting purposes. These include the harbor porpoise (Phocoena phocoena), Dall's porpoise (Phocenoides dallii), the killer whale (Orcinus orca), and harbor seals (Phoca vitulina)). Seasonal migrants to Puget Sound are the northern sea lion (Eumetopias jubata), California sea lion (Zalophus californianus), and the gray whale (Eschrichtius robustus). Northern and California sea lions appear in Puget Sound in the autumn after breeding, and leave the sound in late spring. Minke whales (Balaenoptera acutorostrata) are occasional visitors to Puget Sound and feed on herring and other small schooling fishes. The northern elephant seal (Mirounga angustirostris) is an occasional visitor to Puget Sound and feeds on benthic invertebrates and fishes. The diet of harbor porpoises consists of small fish and invertebrates such as herring and squid. Dall's porpoise feeds primarily on squid and small schooling fishes. In Puget Sound, killer whales eat fish almost exclusively, including salmon, rockfish, and cod. They usually do not

bother other marine mammals in the area. Because killer whales are top carnivores in the marine ecosystem, the entire Puget Sound habitat is critical, particularly where there are large runs of salmon. Harbor seals feed on salmon, herring, shellfish, octopus, and rockfish and are commonly found in Puget Sound bays. In Puget Sound, the endangered gray whales, forage in bays for a variety of benthic invertebrates, mysids, fish larvae, and small schooling fishes.

(5) Water Birds. In general, birds using the potential disposal site areas are birds that feed in deepwater. Dabbling ducks such as mallards, pintails, wigeons, etc., and other shallow-water feeders such as coots, will typically not be in deepwater. Birds living in Puget Sound typically adapted for deepwater feeding includes loons; grebes; cormorants; "bay ducks" such as canvasbacks, scaups, goldeneyes, and buffleheads; oldsquaws; scoters; and red-breasted mergansers. Other birds utilizing deepwater habitats for feeding on a less frequent basis include bald eagles, ospreys, jaegers, various gulls, terns, and alcids such as rhinocerous auklets, common murres, marbled murrelets, pigeon guillemots, and ancient murrelets. Peregrine falcons regularly migrate through Puget Sound (and a few overwinter), but they most often utilize shallow-water or upland habitats for hunting. The majority of the birds listed above are migrants and/or winter residents. Only cormorants, Barrow's goldeneyes, bald eagles, ospreys, some gulls, and all the alcids, except ancient murrelet, nest on or near Puget Sound.

Most of the birds listed above prey on finfish; a few prey on shellfish, particularly mussels, and consequently may frequent shallower water than the other species.

(6) Endangered and Threatened Species. Four species of endangered marine mammals, one endangered bird, and a threatened bird may be seen in Puget Sound. The marine mammals, all whales, are the gray whale (Eschrichtius robustus), fin whale (Balaenoptera physalus), blue whale (B. musculus), and humpback whale (Megaptera novaeangliae). The blue whale has never been verified in Puget Sound waters, though it is speculated that a whale identified as a fin whale in 1930 in Shelton, may actually have been a young blue whale (letter from National Marine Mammal Laboratory, 1980). That fin whale sighting is the only potential record of that species in Puget Sound. Sightings of gray whales in the inside waters of Washington are rare, although Everitt, et al. (1979), indicated that gray whale sightings near Elliott and Commencement Bays occur at a higher frequency than other areas. Humpback whales used to be one of the most frequently observed in Washington's inside waters, until commercial whaling dramatically reduced their numbers. Sightings of this species in the inside waters over the past few years have been rare.

The endangered bird species is the peregrine falcon. There are no known active eyries of this species near any of the proposed Phase I disposal areas. The species regularly migrates through, and overwinters in, specific areas near Puget Sound. The primary wintering areas are in northern Puget Sound, primarily near Skagit, Samish, and Lummi Bays. Nisqually National

Wildlife Refuge may have one or two wintering falcons. Otherwise, central Puget Sound sees an occasional peregrine. There are no areas of regular wintering peregrines in the central Puget Sound area. Bald eagles are listed as a threatened species in Washington. There are several bald eagle nests in the central Puget Sound area, and bald eagles are relatively numerous throughout the year in the area.

Biological Assessments (BA's) prepared for the PSDDA Phase I study area are attached in exhibit A. More detailed descriptions of the area's threatened and endangered species, and their habitat, are provided in the BA's.

c. Human Environment.

(1) Social Economic. Waterborne commerce has contributed significantly to the general economic well being of the central Puget Sound region by creating jobs in the maritime trades and supporting industries and business. The water-related industries in Seattle, Tacoma, and Everett have grown and changed to meet modern needs. An estimated 100,000 jobs are directly or indirectly dependant on port activity at Puget Sound terminals with the value of cargo transferred through these terminals in 1985 exceeding $1 billion. Periodic dredging and disposal of dredged material is essential to continued cargo vessel movements in most waterways and harbor areas.

Also important are the 70 marinas and small boat harbors located throughout the Phase I area. Periodic dredging is required to enable continued use of the more than 5,700 wet slips serving both recreational and commercial fishing boat owners.

Extensive saltwater sport and commercial fishing activity takes place in these areas with an average annual catch of 1,035,000 salmon and 19,000 steelhead trout harvested by (1) recreational fishermen; (2) non-Indian commercial fishing fleets; and (3) Indian tribes fishing in their usual and accustomed fishing grounds. Some of this fishing activity takes place in areas that have been used as unconfined open-water disposal sites or are proposed for future disposal sites.

(2) Navigation Development. Vessels plying the Phase I waters vary from large bulk cargo and container ships, to barges, tug boats, and assorted other craft. Navigation development has occurred in all three of the major urban embayments since before 1900. Over 13.6 miles of deep draft channels and 9.9 miles of shallow draft channels have been constructed and require periodic dredging to maintain adequate vessel clearances. Large navigation improvement projects such as proposed for the lower Duwamish Waterway and the Blair and Sitcum Waterways could be constructed within the planning horizon of PSDDA which extends to the year 2000. Major losses of tidal wetlands, channelization of some rivers, and decreases in productivity of the sound for some species have resulted from the navigation developments (e.g., crabs and salmon rearing, etc.).

(3) Dredging and Disposal Activity.

(a) Historical Activity (1970-1985). Dredging activity has occurred throughout Puget Sound for a number of decades. Over the period 1970-1985, an estimated 16.8 million c.y. of sediment was dredged from waters and nearshore areas in the Puget Sound Phase I study area. Of the total volume, the Corps of Engineers accounted for about 34 percent of the material dredged, while the port authorities in the Phase I area accounted for about 28 percent. The remaining 38 percent of the total dredging activity was undertaken by a diverse group of dredgers including other Federal agencies, the State, local governments, and private developers.

Historically, dredged material has been disposed in a variety of environments. About 60 percent of the material dredged between 1970 to 1985 was disposed in upland and nearshore disposal sites. The remaining material was discharged at designated and undesignated open-water disposal sites located in and around Commencement Bay, Elliott Bay, and Port Gardner. Of the DNR designated sites available for unconfined, open-water disposal of dredged material, approximately 76 percent of the material was disposed at the Fourmile Rock site in Elliott Bay.

During the past 15 years, the availability of upland and nearshore disposal sites has become increasingly scarce, resulting in greater reliance on unconfined, open-water sites for disposal of dredged material. While only 26 percent of the material dredged by the Corps of Engineers went to open-water sites in the 1970's, about 56 percent went to open water between 1980-1985.

(b) Projected Activity (1985-2000). An increase in dredging activity is forecasted over the period 1985-2000 as compared to the prior 15 years, assuming that all are proposed major navigation improvement projects are indeed undertaken. Approximately 22.7 million c.y. of sediment are expected to be dredged from Phase I areas. This represents an increase of nearly 6 million c.y. over the amount of material dredged between 1970 and 1985. Included in the forecast are major dredging projects such as the proposed Navy Homeport project in Everett (3.3 million c.y.), the Duwamish River Widening and Deepening project (2.55 million c.y.), and the Blair Sitcum Waterway Navigation Improvement project in Commencement Bay (2.5 million c.y.). Whether these projects are undertaken will depend on a variety of social and economic factors.

As with past dredging activity, most of the projected dredging is expected in the Elliott Bay area (10.5 million c.y.), although a large volume of material is forecast to be dredged in the Port Gardner area (8.2 million c.y.) providing the Navy Homeport project is undertaken. The least amount of dredging activity is expected in Commencement Bay where only approximately 3.9 million c.y. of material is forecast to be dredged between 1985 and 2000.

(4) Native American Treaty Fishing. In general, commercial fishing activity of the Indian tribes is concentrated during the period from July through January of each year. The first target species typically is chinook salmon, and fishing usually ends with steelhead. The bulk of the commercial

catch value is usually associated with the coho salmon fishery, which peaks in late summer and early fall. Specific fishery efforts in the areas of the potential disposal sites are described in section 3.02c(4) (Commencement Bay area), section 3.03c(4) (Elliott Bay area), and section 3.04c(4) (Port Gardner area). These descriptions are based on information provided by the Northwest Indian Fisheries Commission, some of the individual tribes, and other recently prepared EIS's (U.S. Navy DEIS, 1984; U.S. Navy FEIS, 1985; U.S. Navy EISS (Corps), 1986; Elliott Bay Small Craft Harbor FEIS (Corps), 1987).

Potential impacts of disposal activities to the tribal fisheries described in this chapter are evaluated in chapter 4. The considerations given to Indian treaty fishing concerns are contained in section 2.

3.02 Commencement Bay.

a. Physical Environment.

(1) Geology. Figure 3.2 shows the existing DNR disposal site and the selected and alternate disposal sites in Commencement Bay. Commencement Bay lies at the southern end of Puget Sound's main basin, which connects through Admiralty Inlet and the Strait of Juan de Fuca to the Pacific Ocean near 48d N. To the north of Commencement Bay, the southern portion of the main basin is divided into a number of channels by Vashon Island. To the east of this island lies East Passage, where depths near midchannel average 200m. West of Vashon Island lies Colvos Passage with depths averaging 110m. Connecting the southern ends of East and Colvos Passages is Dalco Passage. Depths in this area shoal over a short distance from 165m near the mouth of Commencement Bay to 44m within the Narrows, a major sill zone of the main basin. Within Commencement Bay, depths lessen gradually from the mouth toward the Bay's head, but shoal rapidly along the Bay's northern and southern sides. A number of waterways adjoin Commencement Bay at its head; several of these waterways are periodically dredged by the Corps. The drainage area for the Puyallup River watershed is approximately 2,455 square kilometers containing mountainous and lowland areas.

(2) Water Quality. Water quality in the main basin of Commencement Bay, exclusive of the waterways, is classified as Class A according to 1984 Washington State Department of Ecology standards. Inner Commencement Bay including the waterways is classified as Class B. City Waterway is classified as Class C.

Due to investigations initiated in 1978 by NOAA and subsequent investigations by others, concerns were raised about chemical contamination and possible adverse biological effects in Commencement Bay. Contamination sources include wastes from approximately 27 NPDES discharges and over 300 nonpoint sources in the Commencement Bay area. Previous investigations of the nearshore waters indicated high concentrations of certain metals in the sediments from the waterways and along the southwest shore. In October 1981, the EPA announced a list of 115 top priority hazardous waste sites targeted for action under

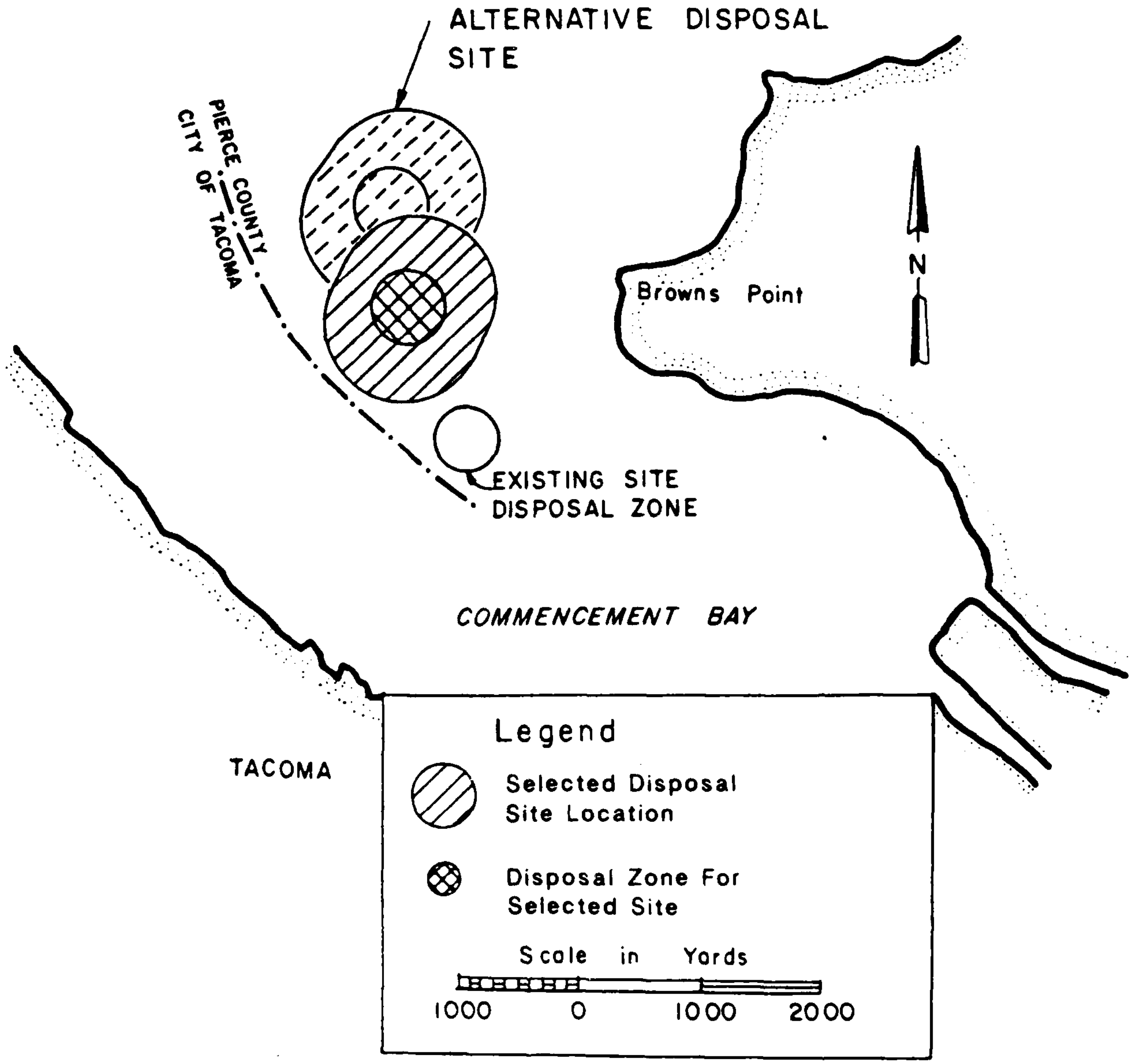


Figure 3.2 **Alternative Commencement Bay Disposal Sites**

Superfund. Commencement Bay was included in the ten highest priority sites in the nation under consideration for Federal funding for necessary remedial action. In September 1983, EPA promulgated a revised priority list that included the Commencement Bay Nearshore/Tideflats site. On April 13, 1983, the EPA announced that an agreement had been reached with Ecology to conduct a remedial investigation of the hazardous substances contamination in the Nearshore/Tideflats Industrial areas of Commencement Bay. Under the Cooperative Agreement, Ecology was delegated the lead role in the investigation. The reader is referred to the Summary Report for the Commencement Bay Nearshore/ Tideflats Remedial Investigation (Tetra Tech, 1985) for a detailed description of chemical concerns in Commencement Bay.

(3) Currents and Sediment Transport. As in the rest of the Puget Sound basin, the circulation in Commencement Bay is driven primarily by tides and is altered by local winds and runoff from the Puyallup River. The resulting net circulation is estuarine in nature, where effects of the river plume are strongly influenced by movement of near surface water, and movement at depth is governed by dynamics of the main basin.

In the East Passage approach to Commencement Bay, the prevailing flow near midchannel is generally westward throughout the water column (Ebbesmeyer, et al., 1984). A shallow surface layer generally flows out of Commencement Bay and merges with the westward flow. At greater depths there are two branches to the flow pattern. The major branch continues to the west feeding into The Narrows. The minor branch turns counterclockwise and enters Commencement Bay (DSI TA).

The Puyallup River's discharge of freshwater into Commencement Bay is approximately 10 percent of Puget Sound's total annual runoff (Ebbesmeyer, et al., 1984).

Vertical profiles of salinity have shown that the Puyallup River plume occupies approximately the upper 2 meters of the water column (Cannon and Grigsby, 1982).

Based on measurements by the city of Tacoma (1979), the time required for a water parcel to travel from the mouth of the Puyallup River to the mouth of Commencement Bay at a depth of 1 foot is approximately a quarter of a tidal cycle. This suggests that water parcels in the Puyallup River plume may quickly exit the Bay (Ebbesmeyer, et al., 1984).

The net current speed and direction at depth (5 m to bottom) within the Bay suggest counterflows across the mouth of the Bay. Previous investigators (Cannon and Grigsby, 1982; Baker and Walker, 1982) have suggested that these opposing net flows may be the result of eddylike circulation. Therefore, in the vicinity of the proposed disposal site, located in outer Commencement Bay, the prevailing flows are westward in the shallow surface layer and southward at greater depth.

Some observations of suspended sediment transport were made in Commencement Bay by Baker and Walker (1982). They found that transport of sediment in the upper portion of the water column was controlled by the Puyallup River plume. They also found that throughout most of Commencement Bay, particle losses from the surface plume are governed by mixing and dilution rather than particle settling. The available data are insufficient to adequately explore the fate of suspended sediment in the river plume; however, losses of suspended sediment from the Bay are thought to occur by advection out of the bay towards Dalco Passage and also into the waterways, as well as some settling within the Bay. There is some evidence that substantial recycling of bottom sediments by resuspension occurs near the entrence to Commencement Bay (Ebbesmeyer, et al., 1984).

Although the proposed disposal site is located in the entrance, it lies in an area where the sediment properties are anomalous, suggesting that here the sediments tend to deposit rather than erode. The small grain size of sediments in this area suggests that the current speeds are less than 25 centimeters per second, a speed below which disposal materials should not be resuspended.

(4) Marine and Estuarine Sediments. The primary source of suspended sediment in Commencement Bay is the Puyallup River. Annual sediment discharge is approximately 395,000 c.y. (Downing, 1983). The Commencement Bay Zone of Siting Feasibility (ZSF) covers an area exhibiting a tongue of fine grained sediments extending from the central basin into the bay. This area within which the alternate and preferred sites were sited exhibited predominantly coarse to fine silt sediments with clay contents greater than 15 percent and volatile solids greater than 6 percent.

Sediment quality studies conducted by Crecelius, et al. (1985) and Hileman and Matta (1983) on or near the DNR Commencement Bay disposal site indicated that sediment chemical levels were very low with the exception of tri- and tetrachlorobutadiene. No evidence of sediment toxicity was found by Swartz, et al. (1982) at the existing DNR site.

(5) Air Quality. The Puget Sound Air Pollution Control Agency (PSAPCA) has jurisdiction over Commencement Bay air quality. PSAPCA administers and enforces air pollution control standards and regulations and is responsible for implementing the requirements of the State of Washington and Federal Clean Air Acts. The following summaries are based on the PSAPCA Air Quality Data Summary for 1985. For carbon monoxide (CO), two of the three Tacoma stations violated or exceeded the average CO standard at least twice. No stations exceeded the 1 hour standard of 35 ppm. For suspended particulates two stations had several values above the primary standard (75 micrograms/cubic meter). Lead concentrations measured at all Tacoma area stations were lower than the ambient standard of 1.5 micrograms/cubic meter. No stations in the Tacoma area exceeded sulfur dioxide standard. There are no ozone stations in the Commencement Bay region, as high ozone levels only occur some distance down wind. There were no ozone levels in Pierce County that exceeded the 0.12 ppm standard.

Nitrogen dioxide levels measured in Puget Sound area have never exceeded the 0.05 ppm standard.

The Pollutant Standards Index (PSI), a nationally uniform index for daily air quality reporting, associates pollutant levels in a 24 hour period with potential health effects. When the PSI is above 100 the measured pollutant level (of CO, suspended particulates, and/or sulfur dioxide) exceeds the national primary air quality standard. For Tacoma, the PSI was exceeded 12 days during 1985.

b. Biological Environment.

(1) Benthic Communities.

(a) Intertidal/Shallow Subtidal Communities. Commencement Bay intertidal and shallow subtidal benthic communities and habitats are representative of those described in detail in the Regional setting section of this EIS (section 3.01b(1)). The bay can be divided into two basic habitat types corresponding with the port waterways and the northeast and southwest shorelines. The communities in the waterways are well described in Volume IV (Invertebrates), of the Commencement Bay Study (Dames and Moore, 1981).

In general, habitat types in the waterways are piling/riprap and soft bottom (sand/silt), both intertidal and shallow subtidal. Dominant taxa in the waterways in terms of abundance and diversity are polychaetes, copepods, gammarid amphipods, and bivalve molluscs.

The northeast shoreline from Hylebos Waterway to Brown's Point, and the southwest shoreline from City Waterway to Point Defiance have very similar habitats to those found in Elliott Bay and Port Gardner, both in the intertidal and shallow subtidal. These include gravel/cobble/sand habitats, concrete rubble/riprap habitats, and silty/sand habitats. Malins, et al. (1980), compared species richness values for benthic infauna for Commencement Bay and found lowest values at the lower turning basin in Hylebos Waterway, and the highest values near Browns Point.

Since these habitats/communities are removed from the selected and alternative disposal sites, (a 2,500-foot guideline used in the site selection process to minimize impacts to shoreline resources) and because they are considered similar to those habitats already described in section 3.01b(1) (Regional Benthic Communities) they are not discussed here. The reader is referred to the Commencement Bay Study referenced above and to the Superfund study prepared for Ecology and EPA for further information. The focus of the impact analysis will be on communities in the immediate and adjacent areas of the selected and alternate disposal sites.

(b) Benthic Communities - Selected Site and Alternative Disposal Site. Site specific benthic studies were conducted in Commencement Bay during June 1986. These studies were conducted by the Waterways Experiment Station (Clarke, 1986) as part of the BRAT (Benthic Resources Assessment Technique)

(Lunz and Kendall, 1982; Lunz and Clarke, 1985) evaluation of habitat feeding potential for demersal fishes. The reader is referred to section 3.02b(3)(e) for a discussion of the results of the fish feeding habitat analysis. In general, the results for both sites show benthic infaunal communities existing in relatively homogeneous coarse to fine silt bottoms dominated by large polychaetes (Maldanidae, Terebellidae, Onuphidae) and bivalve molluscs (Axinopsida and Macoma). The distribution of taxa at the preferred and alternate sites was similar, with polychaetes comprising 67 and 72 percent of the biomass respectively, molluscs (bivalves) respectively making up 28 and 17 percent of the total, and crustaceans comprising only 5 and 6 percent of the total at the two sites. Variations in biomass distribu- tion among stations reflect the patchy distribution of benthos typically documented in benthic investigations (Johnson, 1972; Rhoads, McCall and Yingst, 1978; Kendall, 1983) (figure 3.3). Depth partitioning of benthos at each station indicates that most of the biomass is concentrated within the upper 10 centimeters of the sediment, generally within the upper 5 centimeters (figure 3.4). Average biomass observed within the top 15 centimeters of sediment was 46 g/m2 at the selected site and 70 g/m2 at the alternate site, although differences between sites were not significant (p greater than .05) reflecting the high degree of station heterogeneity. Offsite benthic resource values were generally similar to those observed on site.

In general benthic communities appeared to be similar in taxonomic composition and biomass magnitude (not significant: p greater than .05) to those observed in Elliott Bay and Port Gardner, although substantially higher biomass (i.e., 6.6-7 times) than observed at the Saratoga Passage disposal site (see section 3.04b(1)(b)).

(c) Crab and Shrimp Resources. Dungeness crab (Cancer magister) studies were conducted in Commencement Bay during three seasons: Winter (February, 1986), Spring (June, 1986), and Fall (September, 1986), by the School of Fisheries and Fisheries Research Institute, University of Washington (Dinnel, et al., 1986a). Concurrently, the University of Washington investigated abundances and distributions of commercial (Pandalid) shrimp and bottomfish. Sampling was performed at selected stations in the bay (figure 3.5) using beam trawls for capturing Dungeness crab and shrimp, and otter trawls for capture of bottomfish and shrimp.

No Dungeness crab were caught in Commencement Bay during any of the three sampling seasons. Also, relatively low densities of commercial shrimp were caught baywide (except during September at c station near Browns Point) and in the disposal sites during the same seasons. Distribution of shrimp throughout was generally uniform in February, while shrimp tended to be most abundant at the disposal sites in June (figure 3.5(a-b)). Since the sites were relocated between February and June, the earlier data was only used to provide a general indication of the distribution of shrimp in Commencement Bay in February. June densities of beam trawl caught shrimp were 69 shrimp/ha in the preferred site, and 25/ha in the alternate site.

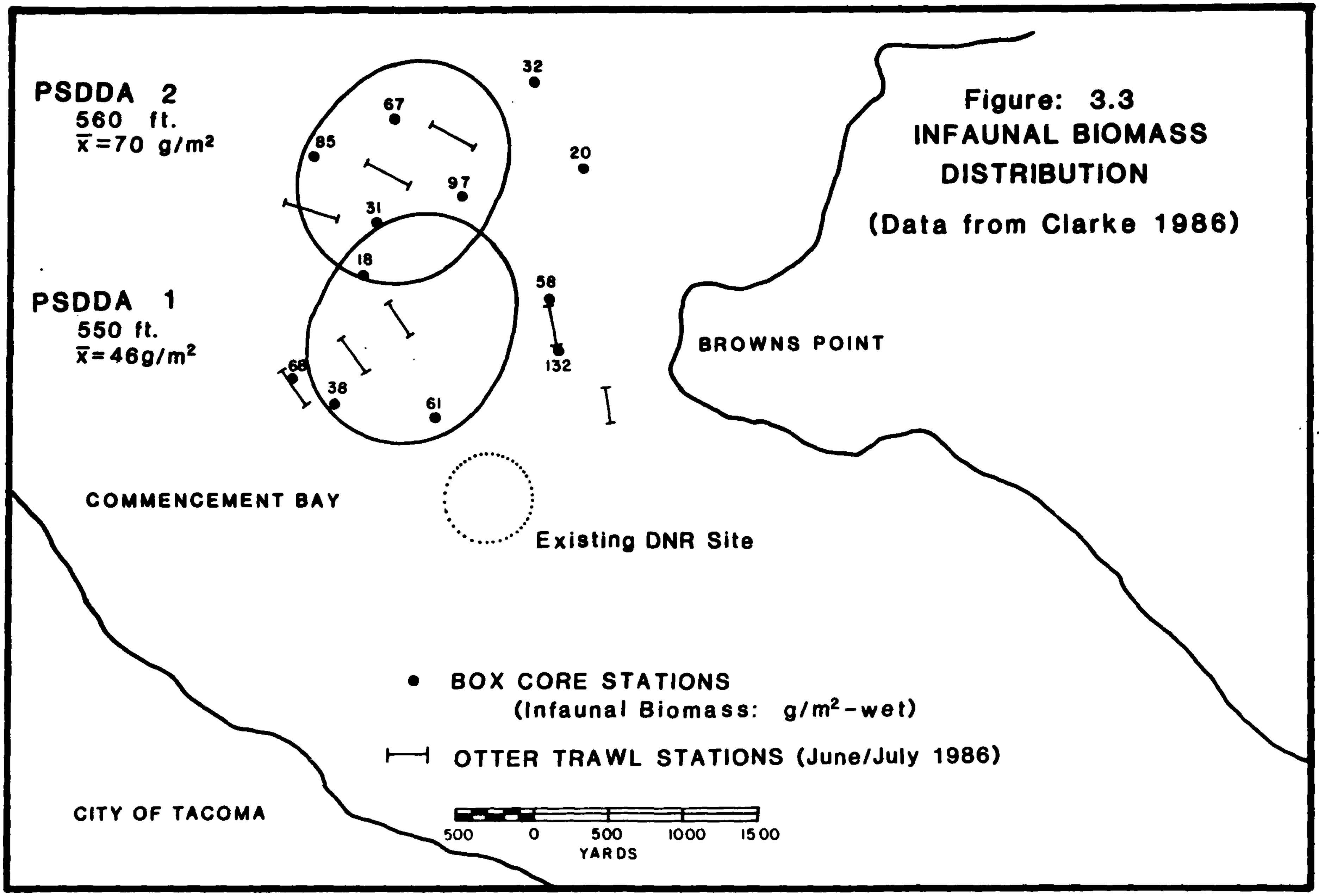


Figure: 3.3
INFAUNAL BIOMASS
DISTRIBUTION
(Data from Clarke 1986)
PSDDA 2
560 ft.
$\bar{x}=70$ g/m²
PSDDA 1
550 ft.
$\bar{x}=46$g/m²
32
67
85
20
97
31
18
58
132
68
38
61
BROWNS POINT
COMMENCEMENT BAY
Existing DNR Site
BOX CORE STATIONS
(Infaunal Biomass: g/m²-wet)
OTTER TRAWL STATIONS (June/July 1986)
CITY OF TACOMA
500 0 500 1000 1500
YARDS

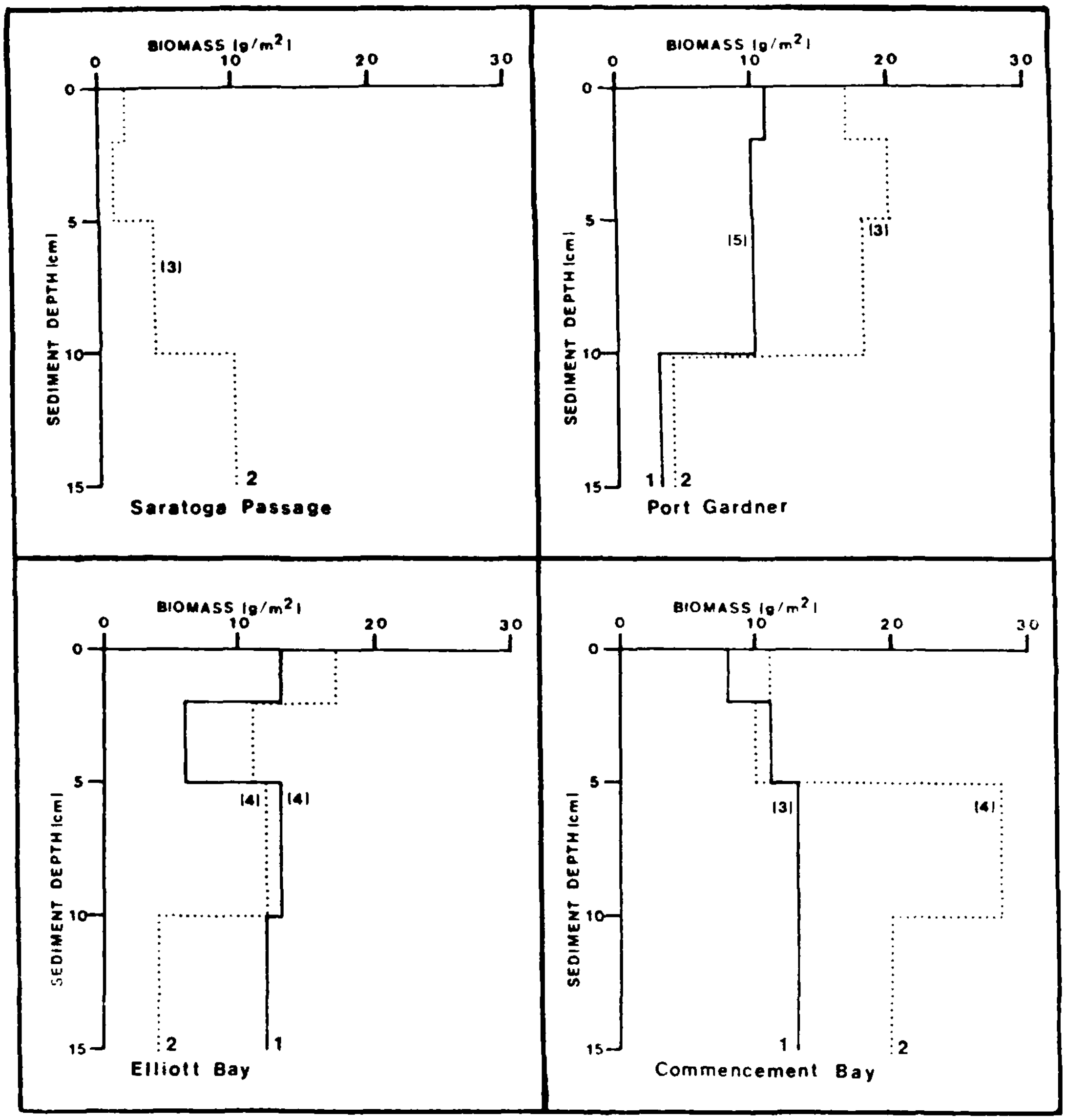


Figure 3.4 Vertical profiles of biomass within the four ZSFs. In each ZSF the values were averaged in the Priority 1 (solid line) and Priority 2 (dotted line) areas. The number in parenthesis indicates the number of samples used in the average. (Source: adapted from Clarke, 1986)

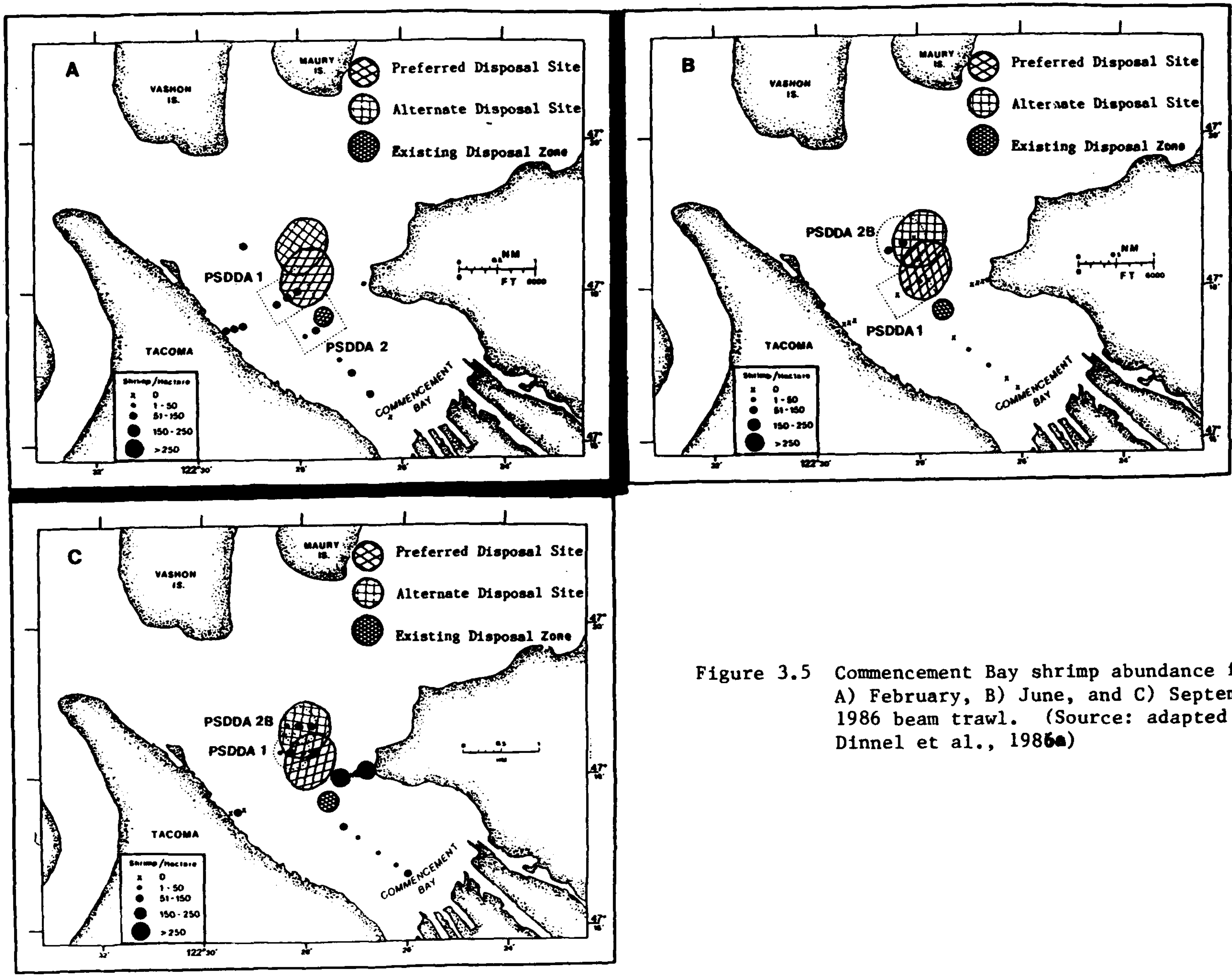


Figure 3.5 Commencement Bay shrimp abundance for: A) February, B) June, and C) September 1986 beam trawl. (Source: adapted from Dinnel et al., 1986a)

In September, the highest density of shrimp taken during beam trawls was at the Browns Point nearshore (10 meter) control station, with a calculated density of 1,067 shrimp/ha (all juvenile coonstripe shrimp, Pandalus danae) (figure 3.5c). Densities in the disposal sites were in the same range as seen in June, 67 shrimp/ha for the preferred site, and 81 shrimp/ha for the alternate site. By contrast, the otter trawl caught 456 shrimp/ha from the preferred site and 476 shrimp/ha from the alternate site. Dinnel, et al. (1986), found no significant differences in shrimp densities between preferred and alternate sites (t-test; p greater than .05). Biomass comparisons for Commencement Bay disposal sites (averaged for Otter Trawl samples collected at both sites), and other areas in Puget Sound indicate that catches were generally lower (1.22 kg/ha) than from areas supporting commercial fisheries for shrimp (ranging from 0.8 - 15.1 kg/ha; averaging 6.99 kg/ha) (table 3.2), although commercially harvestable shrimp resources may be present at one shallow (10m) station off of Browns Point.

In general shrimp data from all seasons and areas (i.e., including Elliott Bay, Port Gardner, Saratoga Passage) indicated species specific depth preferences (figure 3.6). Coonstripe shrimp prefer the shallowest depths (30m), and are often associated with eelgrass and various algae (Dinnel, et al., 1986a). The mid-depths (50-100m) are generally preferred by spot prawns and pink, smooth pink and humpback shrimp. Sidestripe and pink shrimp are found at the deepest (100-150m) depths (Dinnel, et al., 1986a).

Size distribution patterns for shrimp indicated that coonstripe shrimp are the smallest species (average carapace length: 9-12mm) with size increasing with depth. Both species of pink shrimp were small to moderate in size (13-18mm), whereas sidestripe and humpback shrimp are moderate sized (18-24mm) with sizes decreasing with increasing depth. Spot prawn were the largest averaging 26-34mm carapace length and also tended to smaller sizes at depth (Dinnel, et al., 1986b).

(2) Plankton. Phytoplankton and zooplankton communities are generally ubiquitous throughout Puget Sound but exhibit tremendous spatial and temporal variations in species composition and abundances. The reader is referred to paragraph 3.01b(2) for a general discussion on bloom periods and taxonomic/species succession.

(3) Anadromous and Marine Fishes. Three freshwater drainages into Commencement Bay, predominantly the Puyallup River, support five salmonid species (spring and fall chinook, coho, chum, pink, and sockeye) and two species of trout (cutthroat trout and steelhead trout). The Puyallup River basin is by far the largest and most important system of the three with sustaining runs of spring and fall chinook, coho, chum, pink, and steelhead.

(a) Adult Salmonids. Both a fall and spring run of chinook salmon occurs through Commencement Bay waters, with the fall run the largest of the two. The WDF management period for fall-run chinook in Commencement Bay is usually from August through mid-October; the period for spring-run chinook is usually from mid-April to the end of June. Coho salmon are the

TABLE 3.2

ESTIMATED AVERAGE SHRIMP CATCHES PER HECTARE FROM OTTER TRAWLS CONDUCTED IN SELECTED AREAS OF HOOD CANAL AND PUGET SOUND FROM 1967 TO 1979 (UNPUBLISHED DATA, DR. KENNETH CHEW, SCHOOL OF FISHERIES, UNIVERSITY OF WASHINGTON) COMPARED WITH PSDDA PHASE I STUDY AREAS (MODIFIED AFTER DINNEL, et al., 1987b)

Location/Depth (m)	Number of Trawls	Catch (kg)/Ha
HOOD CANAL		
Dabob Bay		
20 - 45	33	2.9
45 - 70	26	2.7
70 - 125	24	3.5
Pleasant Harbor		
35 - 65	5	2.9
65 - 90	8	10.0
Seabeck		
45 - 80	3	0.8
Potlatch		
70 - 90	4	6.8
PUGET SOUND		
Port Susan		
25 - 70	9	12.8
80 - 120	7	5.7
Tulalip		
50 - 80	3	13.5
80 - 120	4	11.8
Carr Inlet		
45 - 80	4	15.1
80 - 135	3	2.4
PSDDA SITES		
Commencement Bay		
550 - 560 (averaged)*		1.2
Elliott Bay		
200 - 560 (averaged)*		1.7
200 - 350 (site 1/September)		4.8
Port Gardner		
370 - 425 (averaged)*		0.1
Saratoga Passage		
350		0.6

*Both alternative sites.

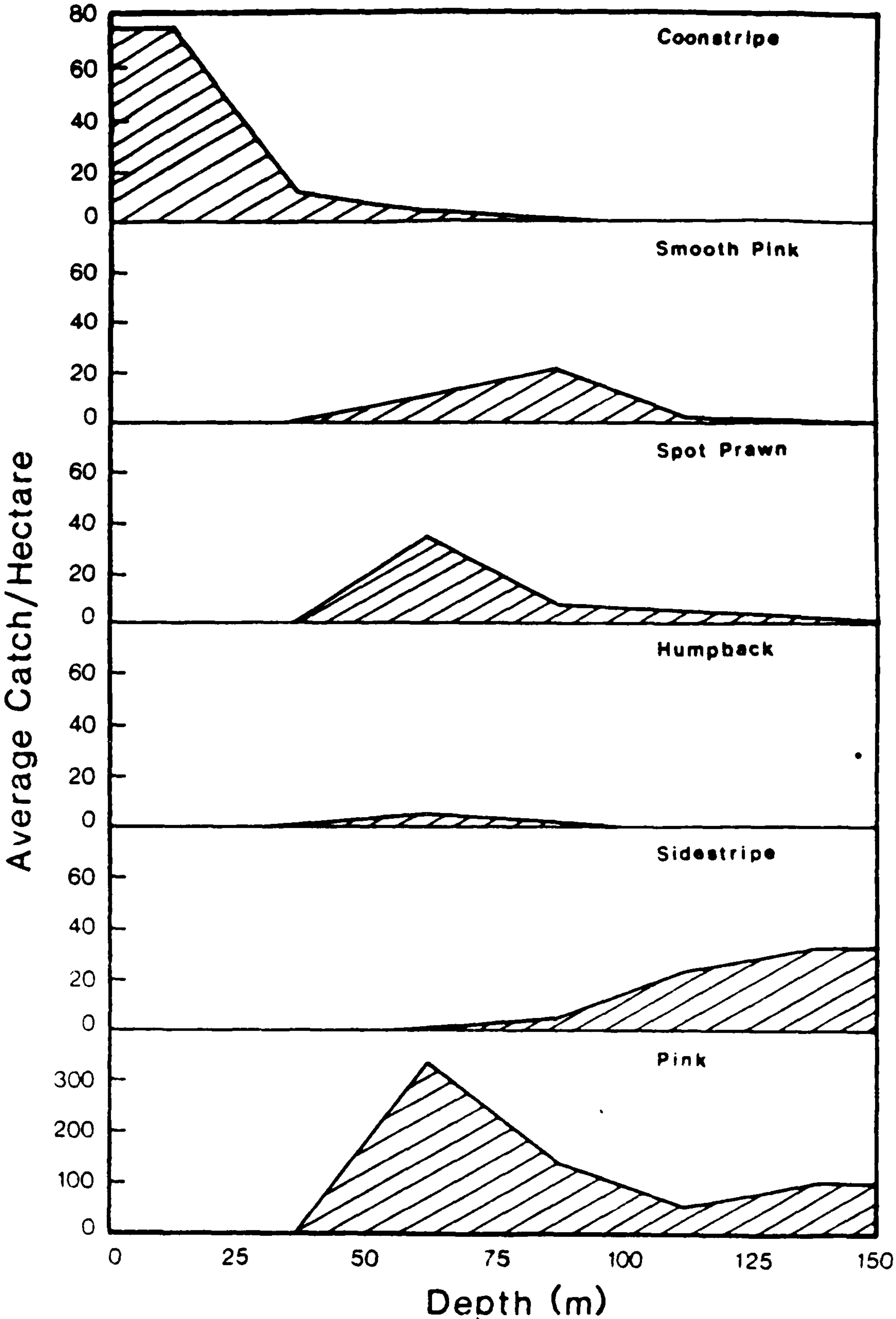


Figure 3.6 Distribution by depth and by species for all beam trawl-caught shrimp, all areas and seasons combined.

(Source: Dinnel et al., 1986a)

predominant sport and commercially caught species. The WDF management period for coho usually runs from the first week in September to the first week in November. The WDF management period for chum usually runs from the first week of November to the first week of January. Pink salmon runs occur primarily in odd-numbered years. The WDF management period for pinks usually runs from the end of July to the middle of September with the peak of the catch often occurring in August. Winter-run steelhead trout are known to occur in Commencement Bay and the Puyallup River, peak freshwater catches are in December and January (section 3.02c(4)) Tribal Fishery Management periods) (see figure 3.7 for upstream migration periods of adult salmon).

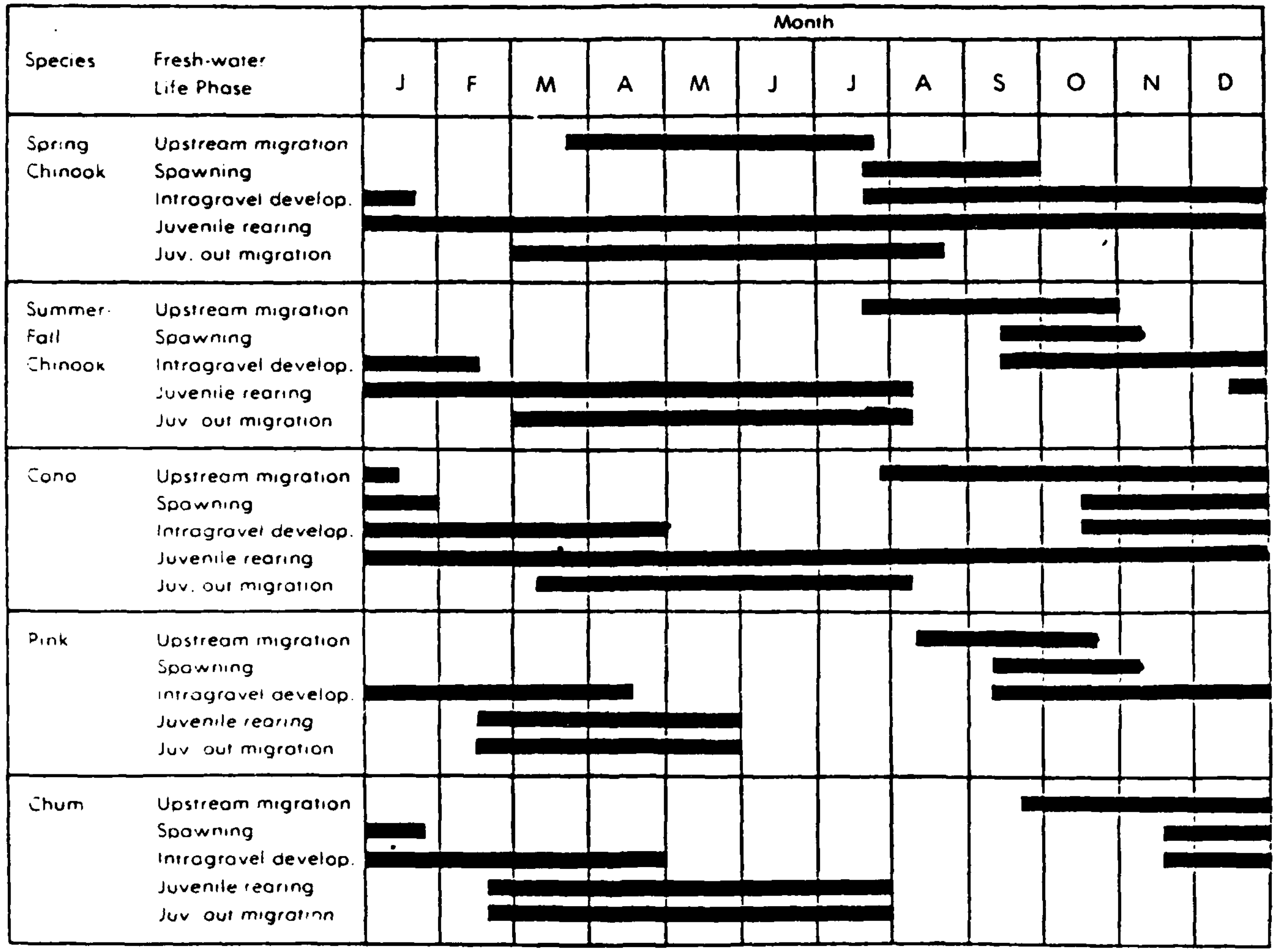
Very little field information exists on adult salmon within Commencement Bay, except general information on adult runs in the bay and rivers/creeks as well as from current sports and commercial fishery activities (see figure 3.7). Based on trap counts and spawning ground surveys, it is estimated that spring chinook spawning escapement to the Puyallup ranged from 800 to 1,500 fish from 1965 to 1971, averaging 1,100 annually. Fall chinook runs (based on spawning ground information) were estimated at 2,500 to 4,000 fish between 1966 to 1971, averaging 3,400 fish (Williams et al., 1975). Coho salmon runs are estimated to have ranged from 42,000 to 70,000 fish between 1966 and 1971, averaging about 50,000 fish per year. Extensive tagging and recovery programs have documented pink salmon escapements to the Puyallup system ranging from 16,000 to 40,000 fish from 1966 to 1971, averaging nearly 26,000 per odd year escapement (Williams et al., 1975).

(b) Juvenile Salmonids. Juvenile chinook salmon are the most abundant juveniles in the bay and are present from early April to late July, peaking in abundance in late May. Juvenile pink salmon are the second most abundant salmon, and are present from late March to June with a peak abundance during mid to late April. Natural production is augmented by hatchery production. WDF operates a salmon hatchery on Voight Creek (a tributary to the Puyallup River). The Puyallup Nation operates a hatchery on Diru Creek (also a tributary of the Puyallup River). Figure 3.7 illustrates the timing of salmon freshwater life phases in the Puyallup Basin.

Shoreline configuration and water depth seem to play a major role in the early distribution patterns of outmigrating juvenile salmonids. Early (April and May) chinook juveniles in Commencement Bay were predominately found along shallow, nearshore beach habitat (Dames and Moore, 1981). Toward late May, chinook began appearing in purse seine catches from deeper water along the face of pier aprons. Juvenile pink salmon showed a strong preference for mudflat and beach habitat. Juvenile chum salmon used nearshore beach and shoreline habitat during their early residency and showed a shift to deeper water along piers after early June (Dames and Moore, 1981).

In general, juvenile salmonids in Commencement Bay feed on epibenthic prey in nearshore environments during the early stages of their outmigration period and shifted to neritic organisms during the later stages of their residency. Harpacticoid and calanoid copepods, gammarid amphipods, and drift insects

Figure 3.7 **Timing of salmon fresh-water life phases in Puyallup Basin** (Williams et al., 1975)



constitute over 90 percent of the prey items taken by juvenile salmonids. A detailed discussion of salmonid and marine fishes and fisheries is contained in the Commencement Bay Study (Volume III) (Dames and Moore, 1981).

(c) Inshore Marine Fish Resources. Marine fish communities in Commencement Bay are generally represented in samples collected during the Commencement Bay Study (Corps, 1981). In the waterway, flatfish were the most abundant group collected and were dominated by English sole, rock sole, flathead sole, c-o sole, sand sole, starry flounder, and speckled sanddab. Less abundant were Pacific staghorn sculpin, Pacific tomcod, ratfish, copper rockfish, and snake prickleback. Species more common along the open-water shoreline included rock sole, c-o sole, and several species of rockfish.

Examination of marine fish during the Commencement Bay Study (Dames and Moore, 1981) showed no gross external abnormalities, and a generally good condition. Several species, however, were infected with the nematode *Philometra* sp.; but the frequency of infestation was no greater than for other areas of central and southern Puget Sound. NOAA/MESA studies (Malins, et al., 1980) in Commencement Bay have demonstrated a high incidence of internal abnormalities or disease in several resident marine fish species, and these abnormalities have been statistically correlated with high levels of heavy metals and organic chemicals in the waterways. The EPA and Ecology Nearshore/Tideflats Remedial Investigation of Commencement Bay conducted under Superfund (Tetra Tech, 1985) documented the extent and distribution of contaminants throughout this area, and added much new information to the earlier COBS observations. This study documented liver lesions in English sole associated with several waterways. English sole collected from Middle Waterway exhibited a liver lesion incidence of 40 percent. Fish observed during the superfund study did not appear to be severely stressed by liver lesions observed or by accumulations of toxic substances from the waterways and along the Ruston shoreline.

Resident flatfish are primarily benthivores, feeding on benthic infauna such as polychaetes and bivalves, but also feeding on epibenthic crustaceans such as gammarid amphipods. Invertebrate numbers/types observed in flatfish stomach content analyses were similar to the infaunal distribution in the study area although considerable between-habitat and seasonal variation was observed. Prey items of marine fish were widely distributed throughout the bay. Infaunal prey items, essentially bivalves and polychaetes, were present at nearly every subtidal station in the COBS study area. Epibenthic prey items were also widespread but were most numerous in subtidal areas in the following locations: Commencement Park, City Waterway at the mouth of Wheeler Osgood, Middle Waterway, and the mouth of the Puyallup River. Bioassays with invertebrate prey species, (Swartz, 1981) indicate that sediment toxicity may not be a problem in deeper parts of Commencement Bay, but may be in the waterways (especially Hylebos Waterway) where sediments often appear to be acutely toxic.

There is currently no commercial fishery for resident marine fish in Commencement Bay. Recreational fishing is common, however, and is concentrated along Ruston Way and City Waterway fishing piers and other areas open to public

access. A recent survey by Noviello (1981) indicated that 95 percent of the fish caught in Commencement Bay are from the southwest side of the bay, with 70 percent caught at or near the old Town and Point Defiance fishing piers. At these piers the catch was dominated by hake, pollock, and Pacific tomcod. From Middle Waterway to Browns Point the fishing effort is much lower, possibly due to restricted access, and the catch is dominated by pile perch and striped seaperch (Noviello, 1981).

(d) Bottomfish Resources in the Disposal Sites. Bottomfish abundance and distribution at the Commencement Bay selected and alternate sites was studied by the University of Washington (Dinnel, et al., 1987b) using a 7.6-meter otter trawl. Sampling was performed during February, June, and September, 1986. February sampling was conducted in two rectangular sites, the original preferred site and the original alternate site. These sites were later modified in June with the overall result being (1) the selected site is located immediately northeast of (and partially overlapping of) the former preferred site, and (2) the current alternate site is immediately north of (and slightly overlapping) the selected site. For purposes of continuity, the discussion will treat data from the February stations as being from the selected site and an adjacent site to the southeast.

In February, neither site appeared to contain major summer populations of recreational or commercial bottom fishes as either juveniles or adults. Bottomfish were scarce at both sites; however, this was due primarily to the fact that sampling was only with beam trawl, not otter trawl, the former being not particularly efficient at, nor designed primarily for, sampling of bottom-fish. In June, otter trawl sampling, revealed little difference in catches between the selected and alternate sites, suggesting a uniform distribution of bottomfish in the central, deep areas of Commencement Bay at this time of year. The catches at the two sites were relatively low (5-9 fish/trawl) and were comprised primarily of ratfish (*Hydrolagus colliei*) and Dover sole (*Microstomus pacificus*).

More bottomfish were caught in September. At the selected site, the average catch was one fish/trawl, representing 6 species. However, an overlapping site, "PSDDA 1A," yielded 29 fish/trawl and 13 species. Dominant species were again ratfish and Dover sole. At the alternate site, average catch per trawl was 18 fish representing 10 species. Dominate species were ratfish, Dover sole, and slender sole. The catch pattern of the dominant species followed similar patterns during both the June and September cruises. From the data, it is apparent that bottomfish are not in either commercial or recreational abundance in Commencement Bay throughout the year.

(e) Foodweb Relationships: BRAT Assessment of Bottomfish Feeding Habitat Values in Disposal Sites. An important aspect of benthic habitat quality is the potential amount of trophic support that a given benthic habitat can provide to demersal bottom-feeding fishes. A procedure called BRAT (Benthic Resources Assessment Technique) was employed by personnel of the Environmental Laboratory, U.S. Army Engineer Waterways Experiment

Station during June/July 1986 at each of the alternative sites to assess bottomfish feeding habitat values (see Clarke, 1986; DSSTA).

The analysis focuses on a parallel examination of benthic infaunal resources and bottomfish feeding behavior within each habitat. Prey size and prey vertical distribution in the sediments are two important attributes of benthic communities important to opportunistic benthic infaunal predators. Benthic Resources in the Phase I disposal sites were quantified in terms of vulnerability (benthic size distribution: 0.25mm, 0.5mm, 1.0mm, 2.0mm, 3.35mm, 6.35mm) and availability (depth of benthic food item below the sediment water interface: 0-2cm, 0-5cm, 0-10cm, 0-15cm). Diets of demersal bottom-feeding fishes collected in each of the study areas were quantified in terms of benthic prey size distribution, and an informed but subjective judgment was made about the probable maximum foraging depth for each fish feeding group. All fish diet samples were analyzed (cluster analysis) and feeding strategy groups were identified based on observed similarities in foraging behavior (i.e., similarities in benthic prey size distributions and probable foraging depths).

Feeding strategy groups identified through this exercise are summarized in table 3.3. The BRAT focuses on benthic infaunal predators and couples the benthic component of fish diets with benthic infaunal resources in the environment. Four feeding strategy groups were identified that exploited infaunal benthos heavily (primarily Dover sole and English sole). Figure 3.8 illustrates the distribution and amount (g/m2-wet biomass) of potential benthic food particles available to each of the four feeding strategy groups. The differential prey size and depth exploitation patterns exhibited among the four different feeding strategy groups identified within the Phase I PSDDA disposal sites, largely reflect the spatial mosaic of benthic infaunal prey availability and vulnerability throughout each study area, during a single "snapshot in time" of the feeding behavior of the species collected. Benthic feeding fish are largely opportunistic feeders, and their feeding behavior over time would be expected to change as a result of temporal changes in the benthic "food" resources. A direct comparison of the prey taxa composition observed in the fish diets showed a close parallel with benthic taxa compositions in the environment (section 3.02b(1)(b)), consisting predominately of polychaetes and bivalve molluscs.

Comparative analysis of mean benthic biomass resource values at Commencement Bay during the summer of 1986 indicates that feeding habitat potentials were generally similar among feeding strategy groups at both preferred and alternate sites, ranging from a low of 13.2 and 21.6 g/m2 for Group IIA predators to a high of 24.3 and 35.1 g/m2 for Group IIIA predators respectively at the preferred and alternate sites (table 3.4). Apparent differences in benthic resource value magnitude for Group IIIA between sites were not significant (p .05), and represent the patchiness of benthic communities throughout the study areas. Summer benthic resource values were generally higher for Group IIB and IIIA predators capable of exploiting prey down to 10cm than for Groups IIA and IIC which were foraging at shallower depths of only 5cm. In general benthic

TABLE 3.3

DEMERSAL FISH BENTHIC PREY SIZE FEEDING STRATEGY
GROUPS OBSERVED IN PHASE I PSDDA STUDY AREAS
(AFTER CLARKE 1986)*

Group I	Fishes feeding on prey less than or equal to 1.0mm or smaller with a modal prey size around 0.25mm. No representatives of this group were found in this data set.	
Group II	Fishes that exploit a wide range of benthic prey sizes, and are not small prey or large prey exploiters. Three subgroups of Group II predators were observed in this data set.	
	Group IIA	Fishes that exploit benthic prey between 0.25 and 2.0mm. A prey size mode of 0.5mm is indicated for benthic prey items.
	Group IIB	Fishes that exploit benthic prey between 0.5 and 3.35mm. A prey size mode of 2.0mm is indicated.
	Group IIC	Fishes that exploit benthic prey between 0.5 and 3.35mm. A prey size mode of 3.35mm is indicated.
Group III	Fishes that do not exploit small sized benthic prey. Exploitation is predominantly among benthic prey that are greater than 3.35mm. One subgroup of Group III predators was observed in this data set.	
	Group IIIA	Fishes that exploit benthic prey in the intermediate size range (0.5 to 2.0mm), although the prey size mode is 6.35mm.

*Reflects only groups feeding predominantly on benthic prey. See Clarke (1986) for expanded discussion.

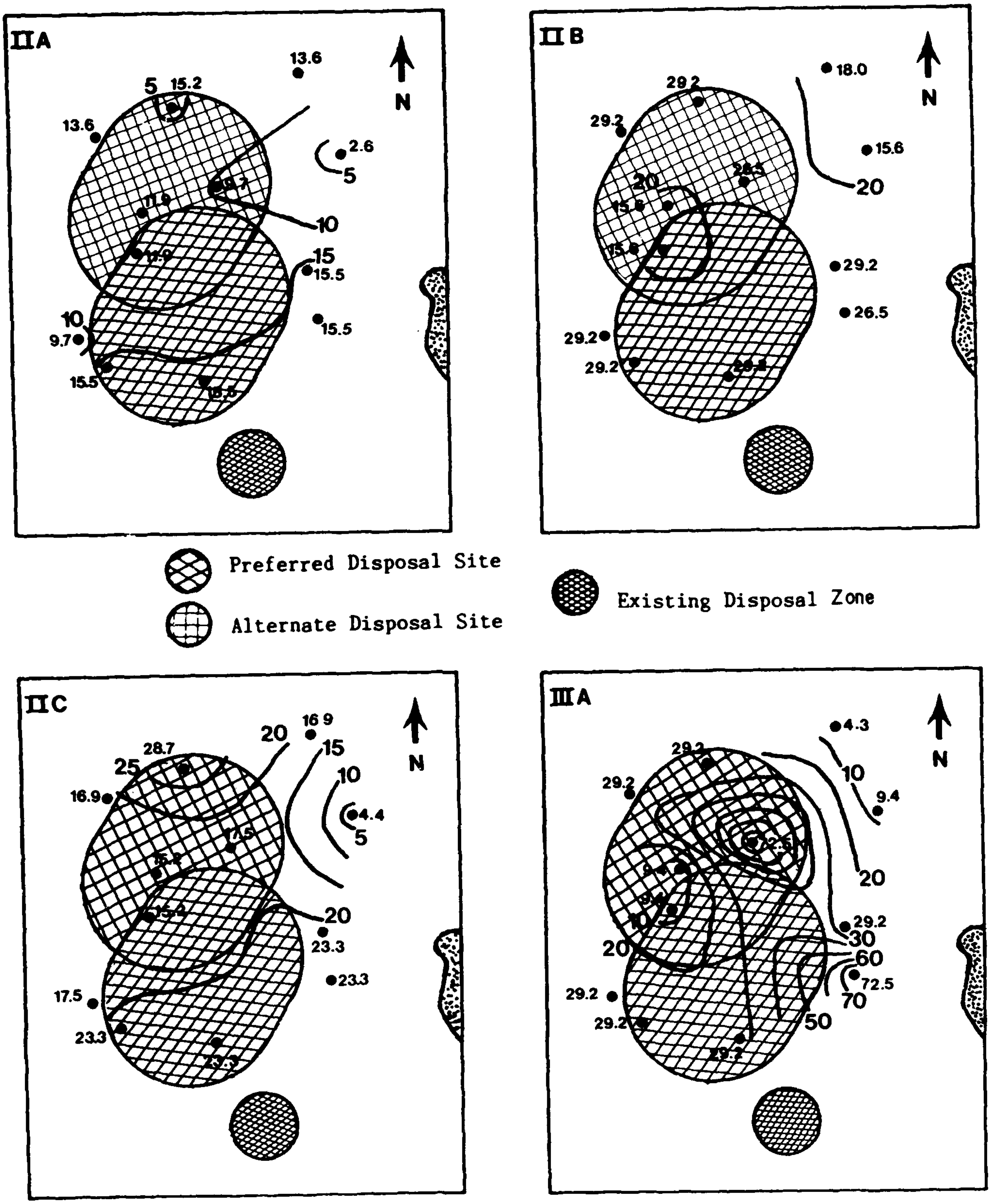


Figure 3.8 Benthic biomass potentially available in Commencement Bay to four groups of fish. Units of biomass are in grams per square meter. (Source: adapted from Clarke, 1986)

TABLE 3.4

STATISTICAL ANALYSIS OF POTENTIAL
HABITAT FOOD VALUE
MEAN AND STANDARD DEVIATIONS HAVE UNITS
OF BIOMASS IN GRAMS PER SQUARE METER

Fish Feeding Group	Study area	Priority 1 Mean	Priority 1 Standard deviation	Priority 1 Sample size	Priority 1 Coefficient of variation	Priority 2 Mean	Priority 2 Standard deviation	Priority 2 Sample size	Priority 2 Coefficient of variation
IIA	Saratoga Passage					2.6	0	4	0
	Port Gardner	12.3	2.4	4	.20	15.2	0	3	0
	Elliott Bay	12.1	4.9	6	.40	13.5	2.6	5	.19
	Commencement Bay	13.2	2.9	4	.22	12.6	2.4	4	.19
IIC	Saratoga Passage					4.4	0	4	0
	Port Gardner	17.8	3.8	4	.21	28.7	0	3	0
	Elliott Bay	16.7	6.9	6	.41	22.7	6.2	5	.27
	Commencement Bay	19.8	4.1	4	.21	19.6	6.2	4	.32
IIB	Saratoga Passage					4.9	0	4	0
	Port Gardner	19.6	6.5	4	.33	28.3	1.6	3	.06
	Elliott Bay	21.2	9.6	6	.45	24.0	7.7	5	.32
	Commencement Bay	25.8	6.8	4	.26	25.1	6.5	4	.26
IIIA	Saratoga Passage					7.2	0	4	0
	Port Gardner	13.1	11.0	4	.84	43.6	25.0	3	.57
	Elliott Bay	21.0	26.9	6	1.28	17.1	11.0	5	.64
	Commencement Bay	24.3	9.9	4	.41	35.1	26.6	4	.76

resource values observed in Commencement Bay were comparable to those in Elliott Bay and Port Gardner, and substantially higher than those observed at the Saratoga Passage alternate site.

(4) Marine Mammals. All of the marine mammals found in Commencement Bay are migratory and have wide distribution patterns. Therefore, they are discussed in the regional setting section. The reader is referred to the regional marine mammals section 3.01b(4) for this discussion.

(5) Water Birds. Commencement Bay provides habitat for relatively large populations of both resident and migratory bird species. The Commencement Bay area in general provides resting and feeding habitat for many species of migratory shorebirds and waterfowl. Commencement Bay functions as both a stopover point during migratory flights and as an overwintering area. Bird distribution in the bay is determined by several factors including habitat availability, feeding behavior, and nesting preferences. Shorebirds and wading birds, such as turnstones, sandpipers, and herons, are exclusively nearshore in distribution and are commonly observed along the shoreline of the outer bay and waterways and in upland areas. Concentration areas of shorebirds and waders include the Hylebos Waterway mudflats and the intertidal area at the Puyallup River mouth. Waterfowl are found in both nearshore waterways and open bay regions with the largest numbers sighted along the Marine View Drive and Ruston Way shorelines and along the banks and at the mouth of the Puyallup River. Gulls and terns are observed throughout Commencement Bay in both nearshore and open bay habitats. Gulls are present in all seasons and are far more numerous than terns, which are present only in late summer. Areas of gull concentration include intertidal mudflats, log storage areas, and abandoned pilings at the mouth of City Waterway. Seabirds are normally sighted in open bay waters and seaward of the waterway mouths. Cormorants are commonly seen roosting on pilings and bulkheads along Ruston Way. Raptors and shorebirds are generally found throughout the terrestrial portions of the Commencement Bay study area. The forested uplands along Marine View Drive and Hylebos Waterway, Point Defiance Park, along the Puyallup River, and wetland areas are all habitats used by raptors and passerines.

Intertidal mudflats in Commencement Bay support feeding activity by shorebirds, waterfowl, gulls, and herons. Mudflats in Hylebos Waterway and at the mouth of the Puyallup River are the major intertidal feeding areas. Open-water areas and some waterways are used as feeding habitat by seabirds and diving ducks (these species probably feed over mudflats at high tide).

Several bird species nest within the Commencement Bay study area. Glaucous-winged gulls maintain a large breeding colony atop boards and pilings of an abandoned pier between Middle and St. Paul Waterways. Bluffs along the Marine View Drive shoreline from 11th Street to Browns Point are used for nesting by belted kingfishers and barn owls. These species construct burrows in the side of the bluffs. Barrow goldeneyes nest among the pilings along Milwaukee Waterway, one of the few known nesting sites for this species in coastal western Washington. Mallards nest in vegetation along the banks of the Puyallup River from its mouth to the Interstate 5 bridge and occasionally nest

in wetland areas between the Puyallup Rivier and Blair Waterway. Several pairs of Canada geese nest along the northeast shore of Hylebos Waterway in the vicinity of the 11th Street Bridge mudflats.

(6) Endangered and Threatened Species. A pair of bald eagles maintain an active nest in Point Defiance Park. Bald eagles are present year round in the vicinity of Commencement Bay. The abundance of open water, prey base, and forested cliffs all contribute to good quality bald eagle habitat in this area. Peregrine falcons have been sighted around Commencement Bay during winter months. The lack of suitable perches, relatively small prey base, and human activity around Commencement Bay contribute to low quality habitat for peregrines.

Gray whales have been regularly, though certainly not commonly, observed in Dalcos Passage and in the outer reaches of Commencement Bay. Gray whales feed in water depths between 40 and 125 feet, primarily for euphausiid shrimp and herring. However, feeding has only been noted in northern migrant gray whales; those migrating south toward the breeding area apparently fast during migration. Those observed in Puget Sound are apparently stragglers who may stay in Washington waters for extended periods. It is apparently not known whether these stragglers feed while they are in Washington waters (Everitt, et al., 1979). Humpback whales used to be regularly observed throughout Puget Sound (Scheffer and Slipp, 1948; cit. Everitt, et al., 1979). They have apparently not been observed near Tacoma or southern Puget Sound since the 1940's (Scheffer and Slipp, 1948; cit. Everitt, et al., 1979). They are now one of the rarest of whales, numbering less than 1,000 individuals, and chances of seeing them in southern and central Puget Sound are remote.

The BA's prepared for the PSDDA Phase I study area are attached in exhibit A. More detailed descriptions of the Commencement Bay threatened and endangered species, and their habitat, are provided in the BA's.

c. Human Environment.

(1) Social Economic. The dredging areas that will use the Commencement Bay unconfined open-water disposal site include portions of King County, most of Pierce County, the city of Tacoma, and other smaller communities like Gig Harbor, Des Moines, and Redondo. Pierce County is the second largest county in the State with a population of 524,900 in 1985. Population growth over the last decade has been due to increases in personnel at military establishments in the vicinity of Tacoma as well as new and expanded industries in and near Tacoma. Population forecasts by the Washington State Office of Financial Management show the population of Pierce County increasing to 618,700 by the year 2000. The tidal flat area, where port activities are concentrated, has experienced major developments in the last several years. Total waterborne commerce through Tacoma harbor has increased from 7,898,000 short tons in 1975 to 15,795,000 short tons in 1985.

(2) Navigation Development. Although the Port of Tacoma was not officially established until 1918, Tacoma has been an active shipping center

since the first settlement came in the 1850's. The last 50 years has seen the Port of Tacoma grow from a 240-acre tract of tideflats to an industrial complex covering 3,500 acres. Commencement Bay, a good natural harbor, has received ships from all over the world. Figure 3.9 and table 3.5 illustrate the historical wetland losses in the Puyallup Estuary and Commencement Bay.

The existing waterway improvements in Tacoma Harbor, both Federal and non-Federal are described below:

o Hylebos Waterway. This channel, over 3-miles long, was completed in 1968 to depths of 30 feet below MLLW for an average channel width of 200 feet. The waterway is a Federal project maintained by the Corps. Existing developments alongside the channel preclude further widening or deepening without substantial costs.

o Blair Waterway. Blair Waterway, a Federal project also maintained by the Corps, is 2.6 miles long with a maximum width of 800 feet.

The federally authorized depth is 35 feet below MLLW, except the southwesterly half seaward of East 11th Street, which is 30 feet below MLLW.

o Sitcum Waterway. The existing 3,000-foot-long by 500-foot-wide waterway was dredged by the Port of Tacoma to depths varying from 30 to 50 feet below MLLW.

o Milwaukee Waterway. The Milwaukee Waterway, located midway between Sitcum Waterway and the Puyallup River, is 3,400 feet long, 300 feet wide, and about 30 feet below MLLW.

o Puyallup Waterway and River. This river is nonnavigable by any but small craft due to depths at the mouth of only about 2 feet above MLLW. Dredging to maintain a navigable channel in this watercourse, with its attendant bedload, is impractical. The present channel of the Puyallup Waterway is a modification of the original natural configuration of the Puyallup River estuary. The river has been channeled by the construction of dikes to a point about 3 miles upstream. Dike construction was a Corps flood control project.

o St. Paul Waterway. This waterway is a privately owned irregularly shaped channel for shallow draft vessels.

o Middle Waterway. The outer half of this waterway is trough-shaped with depths to 30 feet below MLLW while the inner half has elevations varying from 0 to 5 feet above MLLW.

o City Waterway. This waterway is a 7,800-foot-long channel and varies in depth and width as follows:

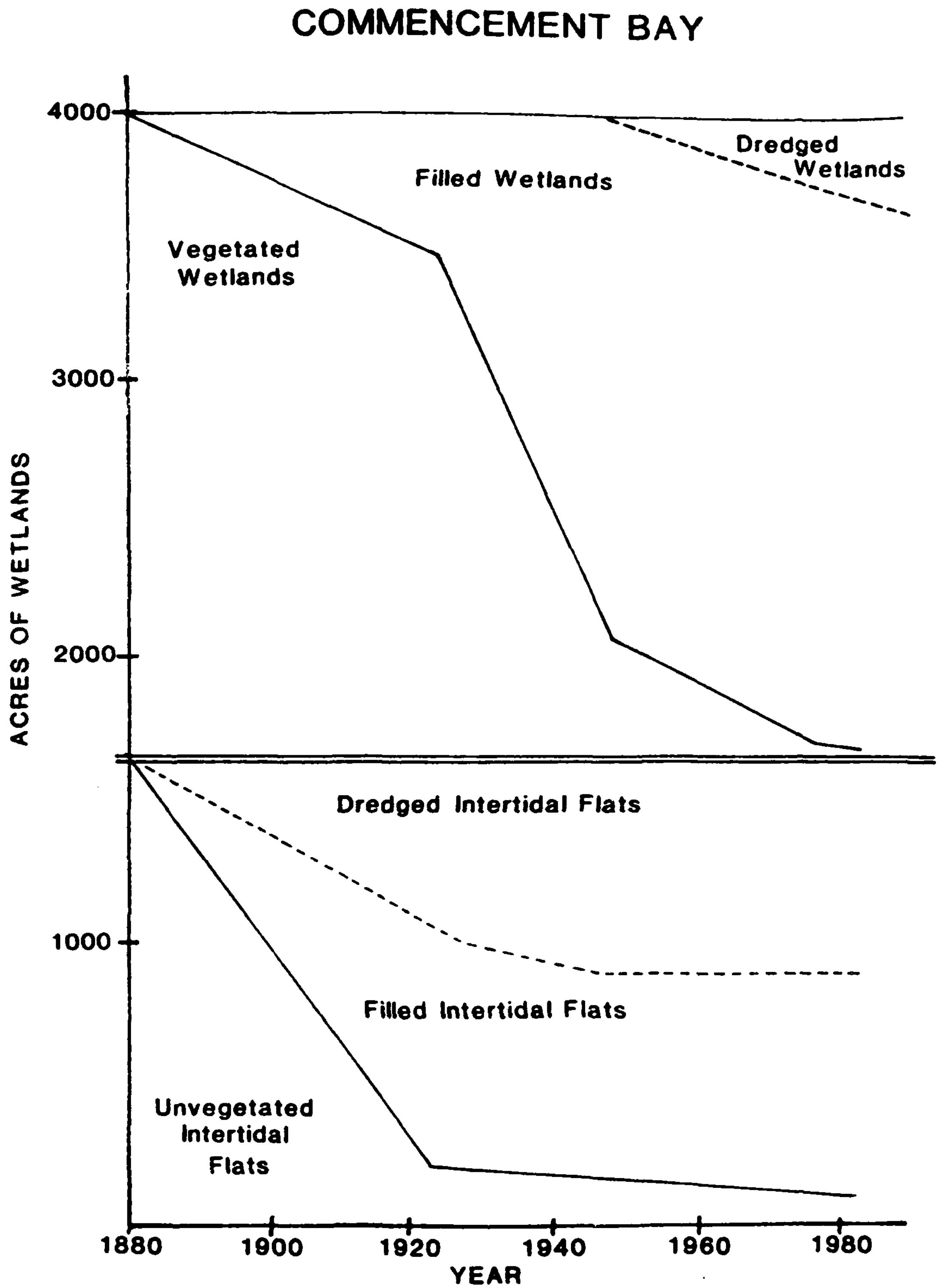


Figure 3.9 Loss of Wetlands in Commencement Bay
(Source: Boule et al. 1983)

TABLE 3.5

ESTIMATED HISTORICAL CHANGES IN NATURAL HABITAT OF PRINCIPAL ESTUARIES OF WASHINGTON STATE*

	Estimated (km2) Subaerial Wetland		
	Historical	Present	% Change
Nooksack	4.5	4.6	+0.2
Lummi	5.8	0.3	-89.7
Samish	11.0	0.4	-96.4
Skagit	29.0	12.0	-58.6
Stillaguamish	39.0	10.0	-74.4
Duwamish	2.6	0.1	-99.2
Puyallup	10.0	0	100.0
Nisqually	5.7	4.1	-28.1
Skokomish	2.1	1.4	-33.3
Dungeness	0.5	0.5	0

*Data from Bortleson, et al. (1980)

	Depth (feet below MLLW)	Width (feet)
Commencement Bay to East 11th Street	29	500
East 11th Street to East 14th Street	22	500
East 14th Street to End of Waterway	19	500 to 250

The waterway is a Federal project maintained by the Corps. Bridges within this waterway restrict the upper reaches to small vessel traffic.

(3) Dredging and Disposal Activity.

(a) Historical Activity (1970-1985). Between 1970 and 1985, 2,951,000 c.y. of material were dredged from Commencement Bay and vicinity. This represents 18 percent of the total amount of material dredged in Phase I areas during the last 15 years (table 3.6). Although some of the dredged material (26 percent of total dredged) was disposed at available open-water sites in the Commencement Bay area, most of the sediment (74 percent of total) was placed upland or nearshore. In the past 15 years, most of the dredging (61 percent of total activity) was undertaken by the Port of Tacoma. The lowest level of activity was by the Corps as little maintenance dredging was required in the Commencement Bay area because of low siltation rates.

(b) Projected Activity (1985-2000). The volume of material expected to be dredged in the Commencement Bay area over the next 15 years is approximately 3.9 million c.y. (table 3.7). This represents the lowest volume of material (17 percent of total) of all three Phase I areas. The Corps or the Port of Tacoma is projected to account for the majority of future dredging in the Commencement Bay area, depending on which entity undertakes the Blair-Sitcum Waterway Navigation Improvement project. If this project is not undertaken, then the amount of material dredged by each of the three general groups that dredge (Corps, Port of Tacoma, and private parties/municipal interests) would be approximately the same.

(4) Native American Treaty Fishing. As part of their "usual and accustomed" fishing area, the Puyallup Tribe possess adjudicated fishing rights in Commencement Bay. The Yakima Tribe additionally possess these rights, and could propose to exercise them in the future.

The Puyallup Nation typically operates a commercial drift gill net fishery for pink (odd year), coho, and chum salmon in Commencement Bay. The commercial fishery in the bay usually occurs from late August to late November. Coho salmon is the predominant species in terms of numbers caught commercially in Commencement Bay. Spring and fall runs of chinook have not been sufficient to support commercial fisheries for those species. Drift gillnet fishing (especially for coho) can occur throughout the bay.

TABLE 3.6

PUGET SOUND DREDGED MATERIAL INVENTORY PHASE I AREA
(SEATTLE, TACOMA, EVERETT) 1970 TO 1985

	Total Volume Discharged at Unconfined Disposal Sites	Total Volume Dredged
Phase I Area	6,758,000 c.y.1/ (5,167,000 m^3)	16,850,000 c.y. (12,890,000 m^3)
Port Gardner	692,000 c.y. (529,000 m^3)	5,499,000 c.y. (4,207,000 m^3)
Elliott Bay	4,598,000 c.y. (3,515,000 m^3)	8,400,000 c.y. (6,426,000 m^3)
Commencement Bay	782,000 c.y. (598,000 m^3)	2,951,000 c.y. (2,257,000 m^3)

	Corps of Engineers Projects	Port Projects	Other Projects
Total Volume Dredged	5,755,000 c.y. (4,400,000 m^3)	4,635,000 c.y. (3,544,000 m^3)	6,460,000 c.y. (4,939,000 m^3)
Total Volume Disposed at Unconfined, Open-Water Sites	2,167,000 c.y. (1,657,000 m^3)	1,389,000 c.y. (1,062,000 m^3)	3,202,000 c.y. (2,448,000 m^3)
Total Volume Disposed Upland or Nearshore	3,588,000 c.y. (2,743,000 m^3)	3,246,000 c.y. (2,482,000 m^3)	3,258,000 c.y. (2,492,000 m^3)

	Disposal Methods for Corps of Engineers Projects			
	1970-1980		1980-1985	
	Volume	Percent	Volume	Percent
Water	961,000 c.y. (626,000 m^3)	26	1,206,000 c.y. (787,000 m^3)	56
Upland/Nearshore	2,661,000 c.y. (1,946,000 m^3)	74	927,000 c.y. (678,374 m^3)	44

1/Not all dredged material discharged at the designated DNR sites.

TABLE 3.7

FORECAST DREDGING VOLUMES (C.Y. X 1,000)
FOR PHASE I AREA (1985 TO 2000)

Activity	Port Gardner and Vicinity	Elliott Bay and Vicinity	Commencement Bay and Vicinity	Total
Corps 1/	3,000 2/	4,200 3/	2,690 4/	9,890
Ports 5/	300	2,000	700	3,000
Other 6/	4,943	4,325	539	9,807
Total	8,243	10,525	3,929	22,697

1/Corps Forecast includes: Port Gardner and vicinity (upper Snohomish, 2 million c.y.; lower Snohomish, 1 million c.y.); Elliott Bay and vicinity (upper Duwamish and upper turning basin, 1,530,000 c.y.; Duwamish widening and deepening, 2.55 million c.y.; Kenmore, 70,000 c.y.); Commencement Bay and vicinity (Hylebos Waterway, 50,000 c.y.; Blair-Sitcum navigation improvement project, 2.5 million c.y.).

2/Volume includes 2 million c.y. of material to be dredged from the upper Snohomish River basin and maintenance project. The material is primarily sand. Adjacent upland disposal is preferred for economic reasons.

3/Includes 2.5 million c.y. for the Duwamish widening and deepening project which has been authorized but is not expected to be undertaken in the short term (1985 to 1990).

4/Includes 2.5 million c.y. for the Blair-Sitcum navigation improvement project which has been authorized but is not expected to be undertaken in the short term (1985 to 1990).

5/Forecasts by Ports: Port Gardner and vicinity (Port Everett includes Everett Port construction, 300,000 c.y.); Elliott Bay and vicinity (Port of Seattle includes T-91 shortfill, 400,000 c.y.; Kellogg Island, 800,000 c.y.; Port maintenance, 800,000 c.y.); Commencement Bay and vicinity (Port of Tacoma includes third Sea-Land berth, 100,000 c.y.; new pier 5 area wharf, 150,000 c.y.; Blair terminal berth, 100,000 c.y.; Blair auto wharf, 120,000 c.y.; Hylebos maintenance, 150,000 c.y.; berth and waterway maintenance, 80,000 c.y.).

6/All other project activities, including private developers, State of Washington, municipal governments, and U.S. Navy. For Elliott Bay and vicinity and Commencement Bay and vicinity, the volume of material to be dredged by this group is based on an extrapolation of the dredging over the period 1970 to 1985. The extrapolation was based on a simple mean of the yearly dredging volume that occurred between 1970 and 1985. This yearly average was extended forward for the 15-year forecast. For Port Gardner and vicinity the same procedure was followed, except that the estimated volume of material that is to be dredged from the Navy Homeport project (3,300,000 c.y.) was included.

During Fall and Winter, the tribe uses stationary gill nets to fish commercially for steelhead in the Puyallup River. This fishery peaks in December. The bulk of the commercial harvest of steelhead in Commencement Bay is occurs in the lower portion of the main stem of the Puyallup River.

Tribal salmon sports fishing in the bay has been concentrated near Point Defiance and the mouth of the Puyallup River. Occasional high-use sport fishing has also occurred near Brown's Point.

(5) Non-Indian Commercial and Recreational Fishing. Commencement Bay supports a limited amount of non-Indian commercial and recreational fisheries activities. The following summary is based on the latest WDF catch statistics for 1985-1986 (Dale Ward, personal communication, 1987). Sport catches of chinook and chum salmon between Tacoma and Vashon Island are reported at 38,157 fish for 1985. Non-Indian commercial catches of salmon in 1986 were only 503 fish (chum only) for Commencement Bay, by comparison. Bottomfish catches of true (Pacific) cod, English sole, and rockfish totaled 9,545 pounds, in 1986 between Commencement Bay and Vashon Island. Herring catches of 46,232 pounds and surf perch (shiners), catches of 14,490 pounds, were reported for 1986 within the area from Commencement Bay to Vashon Island. No significant catches of crab or shimp have been reported from Commencement Bay.

(6) Esthetic Setting. The esthetic setting that could be impacted by disposal operations is Commencement Bay proper, shipping activities, and recreational boating. It also includes the shoreline areas, offshore islands, and the Olympic Mountains. A good description of the shoreline areas is provided in the Commencement Bay Study, Volume II, Land and Water Use (Dames and Moore, 1981). The south shoreline extends from City Waterway to Point Defiance and is bordered by Schuster Parkway and Ruston Way, the latter traversing through Old Tacoma and Ruston. Several public parks, view areas, and restaurants dot this shoreline. The Port of Tacoma industrial area is comprised of several waterways and riprapped shoreline and provides views of the bay for office and industrial workers. The north shoreline is bordered by Marine View Drive and extends from Hylebos Waterway to Browns Point. A private park exists at Browns Point. Other viewpoints are from elevated areas that include: Point Defiance Park, the Ruston-Old Tacoma residential and commercial area, downtown Tacoma (especially high rise office buildings), Northeast Tacoma (including Hyada Park on Browns Point, Browns Point Heights, and Harbor View Heights). The esthetic quality of the bay and associated amenities is also enjoyed by boaters, some of which utilize local marinas for moorage.

3.03 Elliott Bay.

a. Physical Environment.

(1) Geology. Figure 3.10 shows the locations of the existing DNR site at Fourmile Rock and the proposed preferred and alternate sites in Elliott Bay. Soils in the southeast harbor of Elliott Bay consist of three distinct layers of river and bay sediments, primarily deposited from the

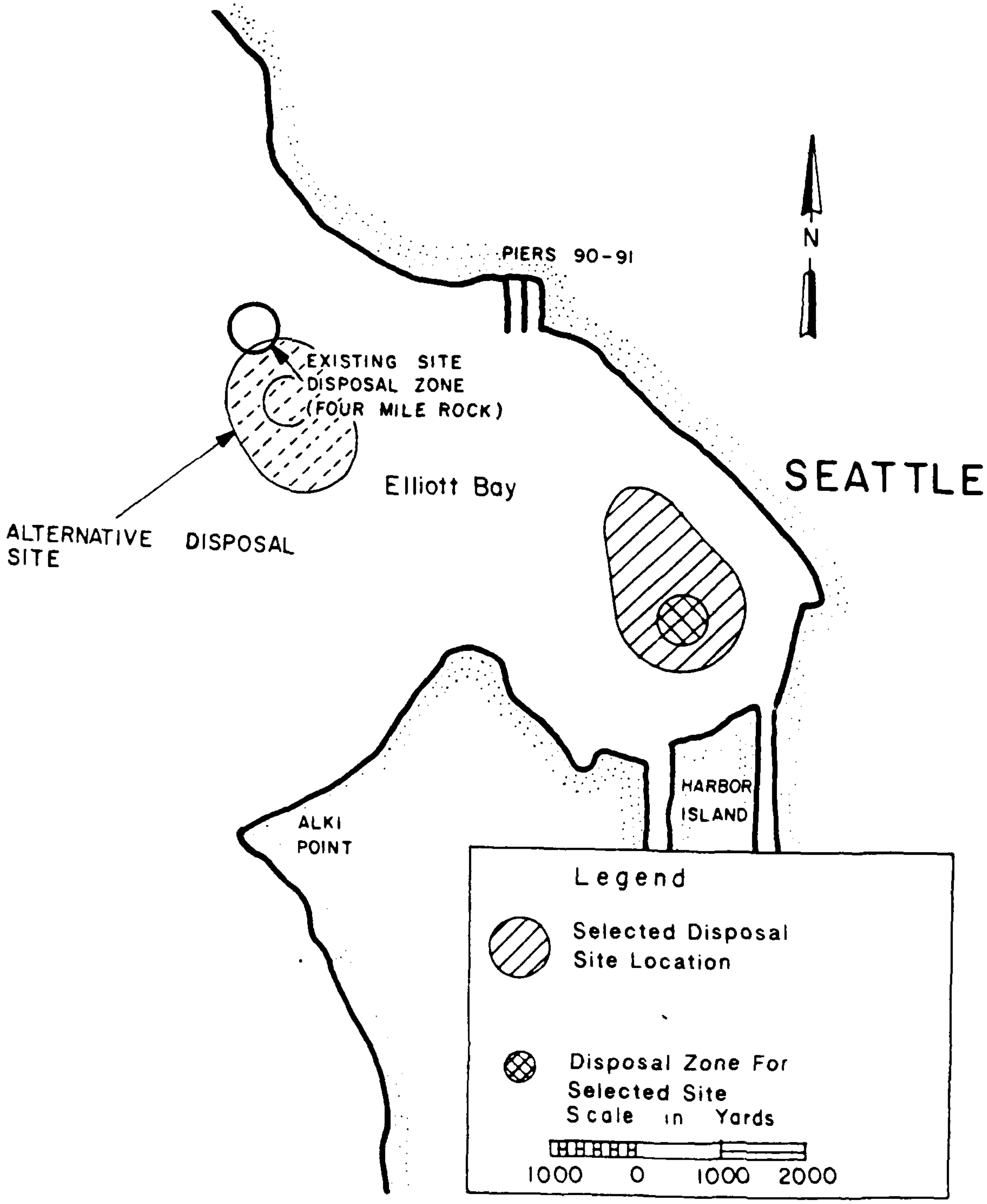


Figure 3.10 Alternative Elliott Bay Disposal Sites

Duwamish Waterway, overlaying a sloping bed of dense incompressible glacial till. The top sediment layer, ranging from 10 to 20 feet thick, is a rich organic silt. The second layer, approximately 30 feet deep, is a loose, silty, fine, unconsolidated, compressible sand. The third layer is a very soft, compressible gray silt. The glacial till is about 90 feet below the existing three-layer mud bottom. The top of the till slopes downward from elevation -50 feet below MLLW to below elevation -230 feet. No unique landforms or mineral deposits are located in the harbor area.

(2) Water Quality. Elliott Bay is a typical estuarine system with a surface layer of brackish or low-salinity water over a deeper layer of more saline water. During the summer, density stratification is present but a strong pycnocline is not present. In the winter, colder freshwater from the Duwamish Waterway mixes with the warmer saline waters, preventing stratification. Water column chemical constituents tend to be rather variable.

Water quality standards have been established and are regulated by the Ecology for marine and freshwaters of the State. The waters of Elliott Bay east of a line from Pier 91 to Duwamish Head are classified as Class A ("very good") by State standards. The waters to the west of this line are Class AA waters ("extraordinary"). Waters of the Duwamish River are designated Class B, which influence the water quality conditions in the area of the preferred disposal site. Water quality in the area of the preferred disposal site is influenced by mixing of fresh and saltwater, as well as circulation patterns and point source effluents. Surface flows from the Duwamish are shown to primarily hug the east shore of the bay. Therefore, pollutants introduced from the Duwamish will pass through the site and some accumulation in bottom sediments would be expected.

As with other classes of water, concentrations of toxic or deleterious material shall be below those which cause acute or chronic conditions. Provided, however, that within established dilution zones water quality criteria shall not apply, but dilution zones will be restricted in area and will be limited to not cause acute conditions.

Using the Ecology water quality standards, water quality in the area of the preferred site is generally good; however, standards are exceeded for coliform bacteria and occasionally for temperature and dissolved oxygen. Water characteristics vary seasonally in response to freshwater runoff from the Duwamish River and snowmelt. Due to high fecal coliform levels, and bacteria levels commercial shellfish harvesting is banned by the State in Elliott Bay.

Dissolved oxygen levels are highest in the spring (10 mg/l) and lowest in the fall (6.2 mg/l). Dissolved oxygen supersaturation is frequent during the time of maximum phytoplankton production. A decrease in oxygen levels during the fall can probably be attributed to the decomposition of the plankton blooms. Oxygen levels during these periods occasionally fall below the State standard. The lowest values were below the standard for Class AA waters, but do not approach the 5 mg/l minimum set by resource agencies as harmful to migratory fish.

Water temperature fluctuates with season and depth. Higher temperatures (13 to 15 degrees C) are found in surface waters during August. Low temperatures (6.5 to 9 degrees C) occur during January and February. This variability is attributable to changes in mean monthly air temperatures, the amount of freshwater runoff, and vertical mixing.

Salinity varies with runoff and precipitation. Surface salinity is higher during late summer, decreasing after winter rains and spring snowmelt. High discharge volumes of freshwater from the Duwamish River cause strong density stratification and low salinity surface layers. Salinity values range between 25 and 30 ppt annually.

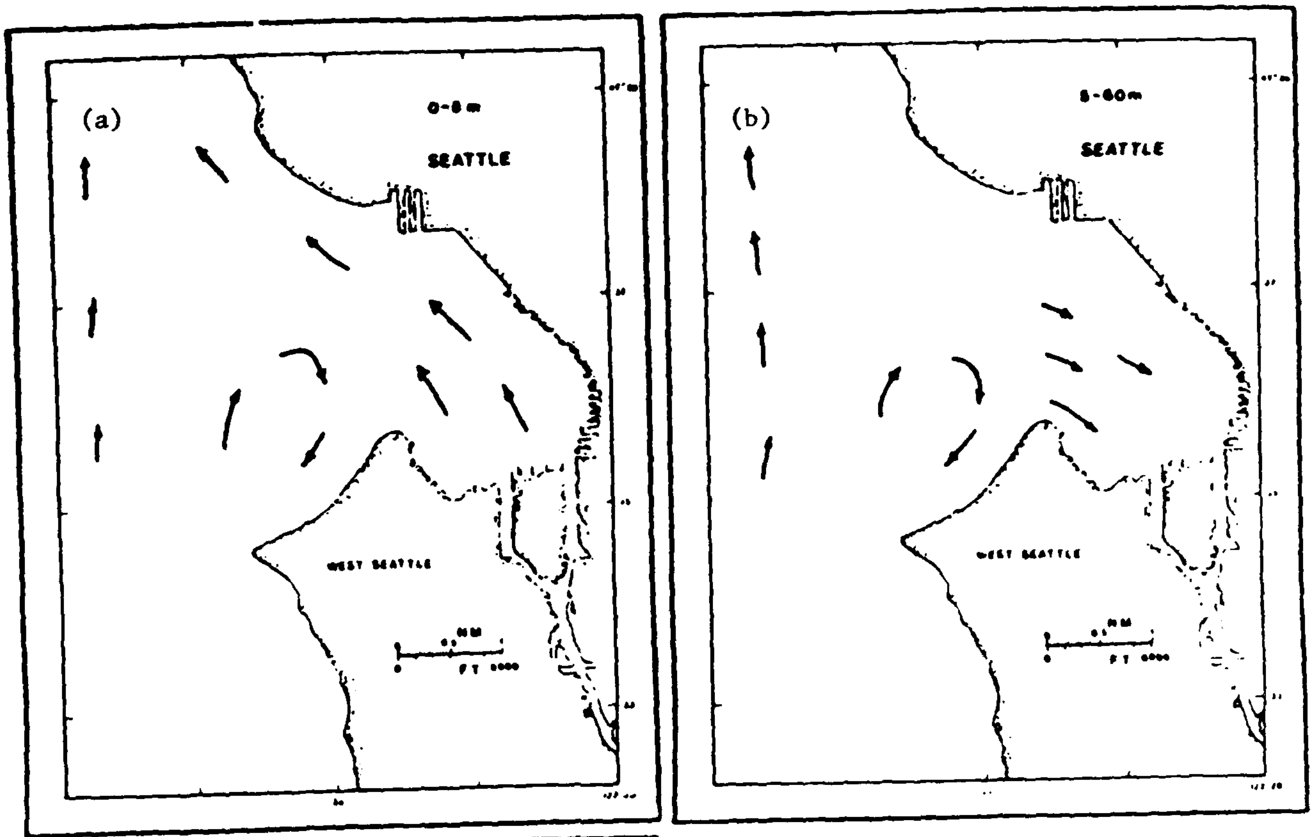
Chemicals of concern are present in Elliott Bay waters. These include organic chemicals such as PCB's and PAH's, inorganic chemicals such as metals, biological contaminants, and mixtures of these contaminants. Organic compounds, many insoluble and toxic to aquatic organisms, are often found in the sea surface microlayer (Word, et al., 1986; Hardy and Cowan, 1986). For inorganic chemicals, of most concern are the heavy metals such as: copper, lead, zinc, cadmium, arsenic, and mercury. Also important as a potential concern is the increased usage of tributyltin compounds in antifouling marine paints, although no problems from these compounds have been identified in Elliott Bay to date. Biological contaminants include bacteria and viruses.

Contaminants may enter Elliott Bay through industrial discharges, sewage effluent from West Point, combined sewer overflows, from point source and nonpoint source discharges into the Duwamish River, and from nonpoint sources such as storm water runoff and discharges from recreational and commercial vessels. According to the PSWQA (1986), point sources are clustered in industrialized urban areas. There are sixteen permitted discharges into Elliott Bay and an unknown amount of contamination enters from unpermitted sources.

Many chemicals of concern tend to remain in the water column where they are dispersed by mixing and circulation out of Elliott Bay. Many chemicals also adsorb to particulates and either float to the surface or are deposited in sediments. Flocculation and stripping of chemicals by suspended particulate matter and dissolved organic carbon is an important contaminant pathway in rivers such as the Duwamish River flowing into Elliott Bay.

(3) Currents and Sediment Transport. Puget Sound's main basin, which Elliott Bay adjoins, has a midchannel prevailing flow (figure 3.11) that is generally northward at depths shallower than approximately 60 meters, and southward at greater depth. As Elliott Bay is entered from midchannel, the prevailing flows generally become weaker and more variable in direction.

The surface layer, containing a substantial amount of freshwater from the Duwamish River, flows northward (counterclockwise), along the Seattle waterfront in the depth range of approximately 0-5 meters (0-16 feet). Below mid-depth, the prevailing flows are weak and erratic, but on average they appear to flow south-southwest toward the head of Elliott Bay. The peak speed



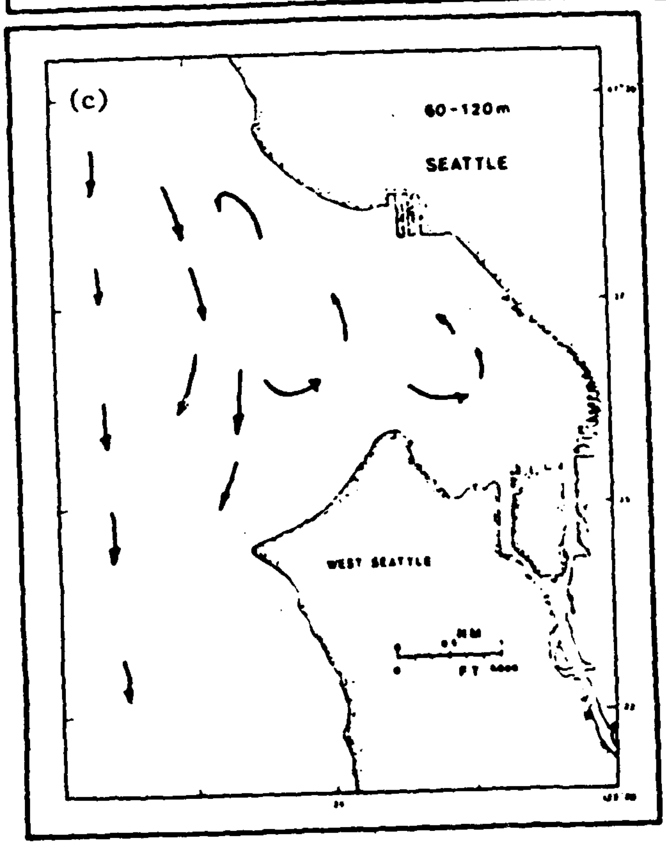


Figure 3.11
Estimated patterns of prevailing currents in Elliott Bay in three layers: upper left, the shallow surface layer in the depth range of 0-5 meters; upper right, the intermediate depth layer in the depth range of 5-60 meters; and lower left, the deep layer in the depth range of 60-120 meters. (Source: Evans Hamilton Inc.)

of the near-bottom current is less than 15 centimeters per second, well below the 25 centimeters per second threshold believed necessary to resuspend a significant amount of dredged material.

In the vicinity of Fourmile Rock, the upper 5 meters of water generally continue to flow toward the north. At greater depth, there appears to be a northward flow that merges with the prevailing flow located toward mid-channel. Peak near-bottom current speeds of 37.5 cm/sec at Fourmile Rock were measured, indicating that some bottom sediments may on occasion be resuspended and transported to the northwest.

(4) Marine and Estuarine Sediments. The primary source of suspended sediment in Elliott Bay is the Duwamish River. Annual sediment discharge is approximately 90,000 c.y. (Downing, 1983). In general, the sediments that settle to the bottom in inner Elliott Bay consist of very fine grained material. Coarse sand is found in the vicinity of the west waterway, but the sediment grades into very fine sand and coarse silt as depth increases. The percent clay in most of the inner bay varies from 9 percent to 12 percent, with values increasing with increasing water depth. Sediment cores indicate that sediments deposit on the bottom of Elliott Bay at the rate of approximately 1 centimeter per year (Lavelle, et al., 1986).

The presence of mud, vascular land plants, wood debris, and freshwater pennate diatoms indicates the influence of the Duwamish Waterway on the southeast portion of Elliott Bay. High concentrations of wood in the shallower depths enhances the high hydrogen sulfide content and blackened sediment that characterizes sites adjacent to piers and pilings found in this area. The grain size distribution of bottom sediments at Fourmile Rock ranges from fine sand in shallow areas to coarse silt in deeper water. Within the disposal site the sediments show a high amount of coarse sand and wood debris, blackened color, and a hydrogen sulfide ($H2S$) odor. Such sediments are typical of the Duwamish Waterway. Disposal at Fourmile Rock has altered the natural coarse/fine silt/clay sediments to coarse/fine sands due to Duwamish maintenance dredging.

The presence of coarse sand and shell debris from shallow living organisms in deep sediments in the western portion of Elliott Bay suggests the role of sediment displacement from Duwamish Head into the bay. Similar transport occurs off West Point.

The wave and tidal-influenced shallow shelf habitats outside Elliott Bay are characterized by compacted fine gray sands with silt contents less than 5 percent of the total sediment content.

Studies by Stober and Chew (1984) for METRO indicate that sediments are degraded in much of the PSDDA selected site and generally throughout Elliott Bay, including the Fourmile Rock disposal site. Sediments analyzed from the preferred site demonstrated elevated levels of organic chemicals and metals, as well as toxic responses in bioassays conducted (Dexter, et al., 1984).

Sediment tested for toxicity inside the Fourmile Rock disposal zone and in the vicinity of the zone to the south demonstrated a toxic response in a study conducted by Stober and Chew (1984), whereas a more recent study by Battelle (1986) found lower toxicity responses from the same areas by comparison. Both studies confirm that sediment qualities in the area of the Fourmile Rock site including the alternate PSDDA site have been degraded by past disposal practices.

(5) Air Quality. The following summaries are based on the PSAPCA Air Quality Data Summary for Elliott Bay in 1985. For carbon monoxide (CO), three of nine Seattle stations violated the 8-hour average CO standard of 9 ppm (10 micrograms/cubic meter) at least twice during 1985. However, over the past several years, though the Puget Sound area has not attained the CO standard, improvement in levels for this pollutant is clearly evident. Lead concentrations measured at Seattle stations were lower than the ambient standard of 1.5 micrograms/cubic meter, except for one Harbor Island station, reflecting effects from closure activities at a lead smelter south of station. Sulfur dioxide levels at the two Seattle stations did not violate the national standards. Relative to ozone, there are no stations in the Elliott Bay region, as high ozone levels normally occur only some distance downwind of the Seattle area. No measured ozone levels in King County exceeded the 0.12 ppm standard. Nitrogen dioxide levels were within the standard of 0.05 ppm. Suspended particulate stations in the Seattle Duwamish valley showed that values exceeded the primary standard of 75 micrograms/cubic meter (for particulates smaller than or equal to 10 micrometers).

Based on an air quality analysis conducted for the Pier 91 expansion EIS (Port of Seattle, 1982), a background carbon monoxide level was determined. The ambient CO background was estimated at 2.3 ug/m3.

The Pollutant Standards Index (PSI), a nationally uniform index for daily air quality reporting, associates pollutant levels in a 24-hour period with potential health effects. When the PSI is above 100 the measured pollutant level (of CO, suspended particulates, and/or sulfur dioxide) exceeds the national primary air quality standard. For Seattle PSI was exceeded 13 days during 1985.

b. Biological Environment.

(1) Benthic Communities.

(a) Intertidal/Shallow Subtidal Communities - North Elliott Bay Shoreline. This shoreline is located approximately 1.7 nautical mile (nmi) northwest of the selected disposal site, and less than 1 nmi northeast of the alternate site near Fourmile Rock. The marine biology of the area is well described in the Corps EIS for the proposed Elliott Bay Small Craft Harbor (Corps, 1987). The following discussion is taken from that EIS.

The north shoreline is characterized by one intertidal habitat type and three major subtidal habitat types. The intertidal habitat ranges in bottom elevation from +11 feet MLLW (mean lower low water) to -4.5 feet MLLW. The +6 foot

bottom elevation is considered the upper limit of prime habitat. The shallow subtidal habitats range from -4.5 feet to -8.0 feet MLLW, whereas the deep subtidal habitats exist deeper than -8.0 feet MLLW. The intertidal habitat has a wide range of substrate types, ranging from sand, cobble, boulders, to a clay hardpan. The reader is referred to the Regional Setting for central Puget Sound benthic communities for a description of typical species dominants within each habitat type (section 3.01b(1)).

Geoduck clams can be important commercially, however due to fecal coliform values in excess of State water quality standards for Class AA waters, commercial harvests are banned by the State in Elliott Bay. Reconnaissance dives associated with the Elliott Bay Marina Project indicated the presence of these clams west of Pier 90/91. Seasonally corrected counts averaged about 1,150 clams/acre (convert to hectares). Based on WDF criteria (1973) these counts are too low for commercial harvesting (i.e., low counts = 2,400 clams/acre).

(b) Piling/Riprap and Shallow Soft Bottom Communities - Altered Shoreline Pier 90/91 southeast to Harbor Island. These communities are generally described in several publications, including the U.S. Navy DEIS for the Carrier Battle Group (CVBG) Homeporting in the Puget Sound Area, Washington State (U.S. Navy, 1984) and the Port of Seattle DEIS on alternative uses for Terminal 91 (POS, 1980). Most of the shoreline has been extensively altered for port related activities. Piling/riprap communities described herein are typically similar with small variations throughout Elliott Bay. Intertidal and subtidal communities in and around the slips of Terminal 90/91 consist of piling, riprap, and soft bottom communities. Lists of species, their locations, preferred habitat, and relative abundance in Elliott Bay are provided in the U.S. Navy DEIS for the proposed Puget Sound Homeport (U.S. Navy, 1984). On the apron pilings, barnacles (Balanus sp. and B. glandula), hydrozoans and ectoprocts are generally dominants. The polyclad flatworm Notoplana spp. and the polychaete Paleanotus bellis are found in moderate numbers scattered throughout the piling habitat. Balanus larvae have been identified as being a food source for juvenile salmonids. Exhibiting somewhat patchy distributions, the blue mussel (Mytilus edulis) and the anemone, Metridium senile exhibit heavy concentrations on some pilings. Riprap substrates under Terminal 90/91 and other similar habitats typically have much lower abundances and species diversity than adjacent habitats. Dominant organisms are Balanus spp. and ostracods.

Soft bottom habitats within and adjacent to the piling/riprap habitats are dominated by polychaetes and molluscs. Polychaetes normally include Tharyx sp., Nephtys cormuta franciscana, and Boccardia proboscidea, whereas mollusca species such as Axinopsida serracata and Macoma spp. are typically dominants. Crustaceans are usually found in low densities.

Macrophytes typically found on pilings represent three algae phyla; green algae (Ulva, Enteromorpha), brown algae (Laminaria, Fucus), and red algae (Rhodophyta).

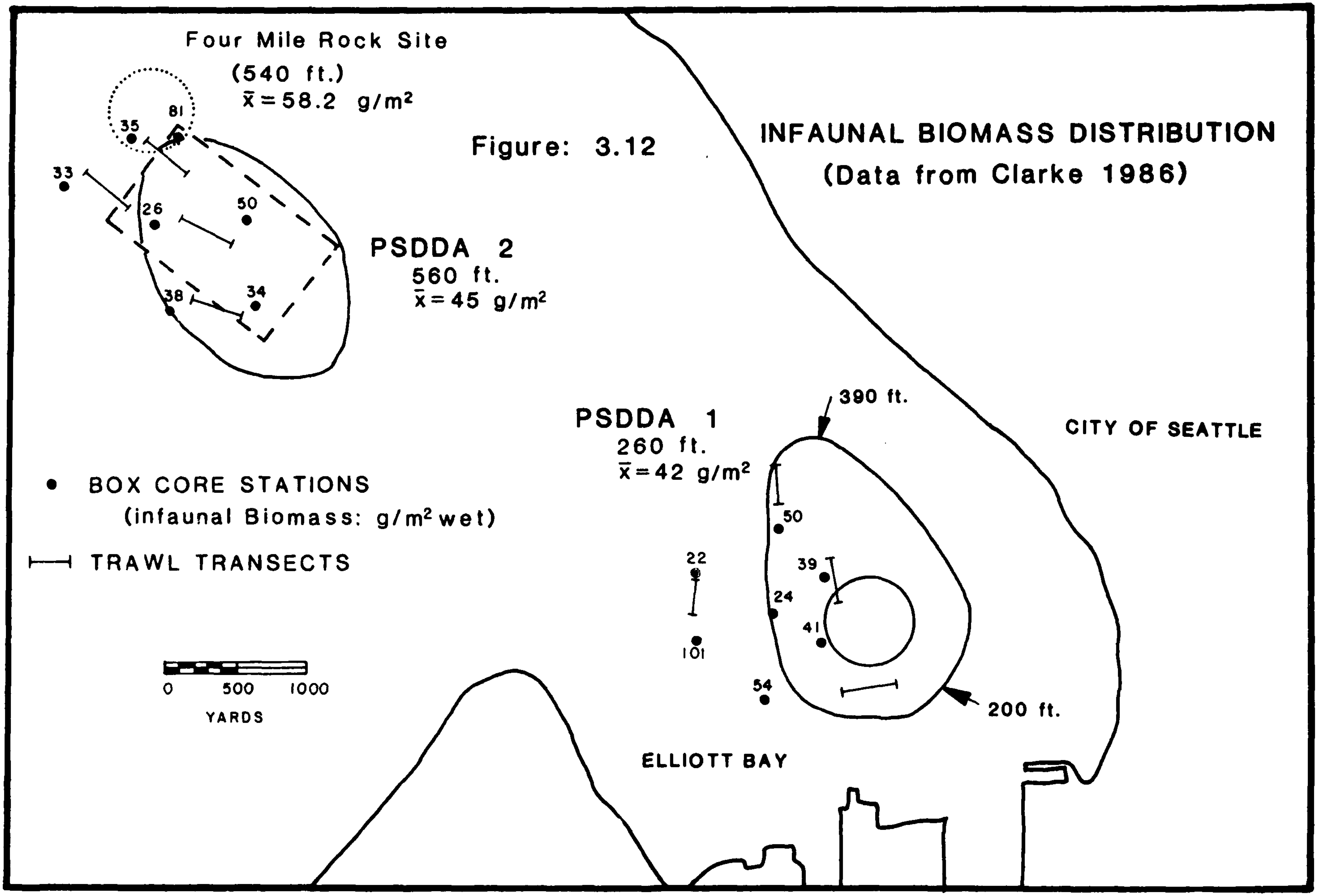
(c) Intertidal/Shallow Subtidal Benthic Communities - Duwamish Head Vicinity/South Shoreline. Marine benthic habitat types found in this vicinity are similar to those previously described for the north Elliott Bay shoreline. Aquatic macrophytes tend to be concentrated on riprap, rocks, and concrete fragments. Dominant species include the following: sea lettuce (*Ulva lactuca*), rockweed (*Fucus distichus*), sugar wrack (*Laminaria saccharina*), bull kelp (*Nereocystis luetkeana*), seersucker (*Costaria costata*). Small beds of bull kelp (less than 1 acre total) occur at several locations subtidally along the shoreline.

Typical infauna include butter clams (*Saxidomus giganteus*), littleneck clams (*Protothaca staminea*), and macoma clams (*Macoma* spp.) and several families of polychaetes (Terebellidae, Capitellidae, and Glyceridae).

Common epifauna on rock substrates include barnacles (*Balanus glandula*), snails (*Littorina* spp.), isopods (several species), and chitons (several species). Organisms commonly found under rocks include shorecrabs (*Hemigrapsus oregonensis*, *H. nudus*), the purple shorecrab (*Petrolisthes eriomerus*), red rock crab (*Cancer productus*), numerous sea urchins, and gunnels. Less common is the skeleton shrimp (Caprellidae). In the high intertidal zone, large rocks and pilings provide habitat for barnacles, sea anemones, and mussels (*Mytilus edulis*).

(d) Benthic Communities - Preferred Site and Alternative Site. Site specific benthic studies were conducted by the Waterways Experiment Station in Elliott Bay during June 1986 (see Clarke 1986; DSS TA). These studies were conducted as part of the BRAT (Benthic Resources Assessment Technique) evaluation of demersal fish feeding habitat potential. The reader is referred to paragraph 3.03b(3)(e) for a discussion of the results of the fish feeding habitat analysis. The selected and alternate sites exhibited fine textured bottoms of predominately coarse silt and clay contents greater than 12 percent.

In general the results from both sites depicted benthic infaunal communities dominated by large polychaetes (Maldanidae, Terebellidae, Onuphidae) and bivalve molluscs (*Axinopsida* and *Macoma*). Taxonomic compositions differed between the two sites, with polychaetes comprising 51 percent of the total at the selected site and 35 percent at the alternate site. Molluscs made up 39 percent of the total at the selected site, whereas they comprised 58 percent of the biomass at the alternate site. Crustacean biomass was uniformily low at the two sites at 4 and 7 percent of the preferred and alternate totals respectively. Variations in biomass distribution among stations reflect the patchy distribution of benthos typically documented in benthic investigations (Johnson, 1972; Rhoads, McCall and Yingst, 1978) (figure 3.12). Depth partitioning of benthos (i.e., within the sediment core collected) at each station indicates that most of the biomass is concentrated within the upper 10 centimeters of the sediment, generally within the upper 5 centimeters (figure 3.4). Infaunal biomass measurements were similar in magnitude between the two sites in Elliott Bay. Average total benthic biomass (i.e., 0-15cm cumulative


INFAUNAL BIOMASS DISTRIBUTION
(Data from Clarke 1986)
Four Mile Rock Site
(540 ft.)
x̄ = 58.2 g/m²
PSDDA 2
560 ft.
x̄ = 45 g/m²
PSDDA 1
260 ft.
x̄ = 42 g/m²
390 ft.
200 ft.
CITY OF SEATTLE
ELLIOTT BAY
81
35
33
26
50
38
34
50
22
39
24
41
101
54
● BOX CORE STATIONS
(infaunal Biomass: g/m² wet)
TRAWL TRANSECTS
0
500
1000
YARDS
Figure: 3.12

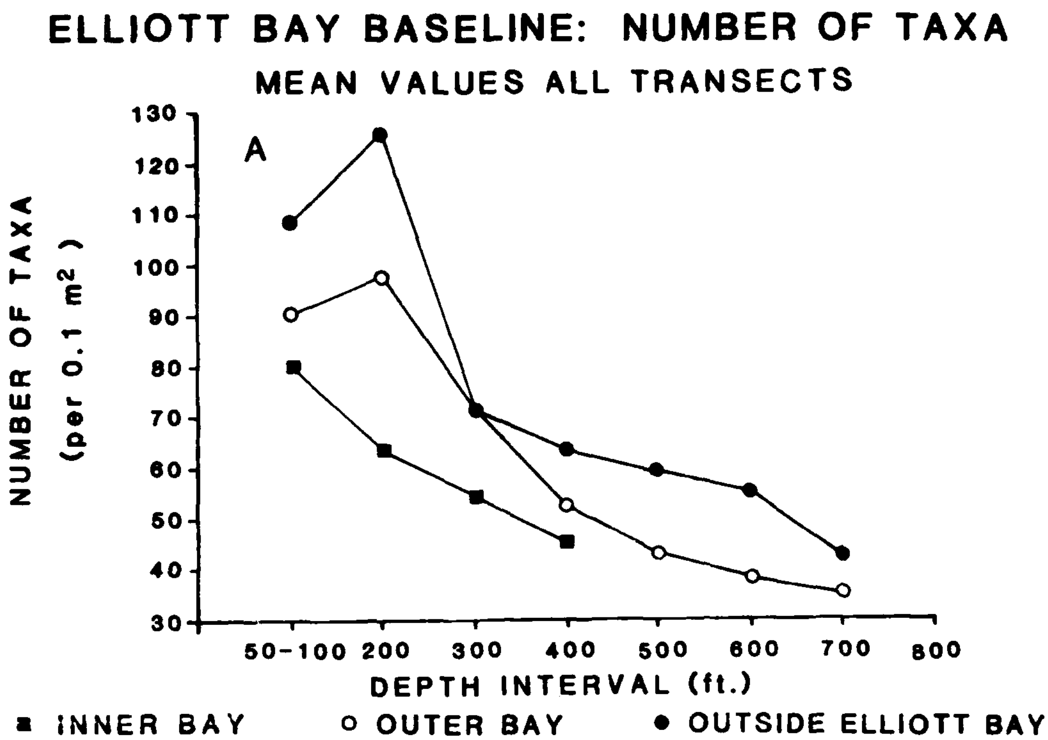
depth) was 42 g/m and 45 g/m2 at the selected and alternate site respectively, although the selected site is located in water some 300 feet shallower than the alternate site (260 feet to 560 feet).

In an area just west of the selected site Word, et al. (1984), documented a depression in benthic species and individuals at depths between 400 and 500 feet from Alki Point to Duwamish Head. The area reflecting a depression in abundance and species including the selected site is in a region where increased quantities of conventional chemical contaminants have been documented. Word, et al. (1984), observed a trend of decreasing numbers of taxa and abundances with increasing depth in Elliott Bay (figure 3.13(a-b)), although there does not appear to be a corresponding decrease in biomass with depth (Striplin, personal communication 1986). This suggests that average infaunal size increases with depth, which may be a reflection of the generally lower frequency of physical disturbance allowing the establishment of stable "equilibrium" type (stage III) communities dominated by larger, long lived species typical of those observed during the June benthic sampling cruise. The fall 1985 SVPS survey of the inner Elliott Bay ZSF and the ZSF at Fourmile Rock also characterized these areas as a dominated largely by stage III (equilibrium) communities, although the Fourmile Rock ZSF also showed stage I communities (pioneering species) characteristic of disturbed bottoms (SAIC, 1985; Cooper Consultants, 1986; DSS TA). RPD depths averaged 1.2 cm and 11.5 cm respectively at the Fourmile Rock and Inner Elliott Bay ZSF's. In general the RPD depth increased with increasing distance from the Fourmile Rock disposal site demonstrating apparent disposal impacts on the benthos. Dredged material was observed in photographs taken at stations in the vicinity of Fourmile Rock disposal site, with benthos dominated largely by stage I communities.

(e) Crab and Shrimp Resources In and Near the Alternative Disposal Sites. Crab and shrimp resources in Elliott Bay were sampled by beam trawl in the selected and alternate sites during February, June, and September, 1986 by the University of Washington (Dinnel, et al., 1986a). Dungeness crabs were absent from all trawls in February, even though commercial crab pots were observed just north of the alternate disposal site. Average densities of shrimp were highest at the preferred site (300/ha) as compared to the alternate site (44/ha) (figure 3.14a).

In June, again no Dungeness crabs were caught at either disposal site and only two were caught elsewhere, at the shallow stations near Duwamish Head. Shrimp average densities in June were the reverse of the February situation, with 81 shrimp/ha at the preferred site and 175/ha at the alternate site (figure 3.14b). Shrimp catch calculations (from otter trawl data) for the selected and alternate sites were 1.14 kg/ha, and 0.39 kg/ha respectively.

In September, again, no Dungeness crabs were caught at either potential disposal site and only two crabs, both nongravid females, were caught at sampling sites in Elliott Bay. Both of these were caught in shallow water off Duwamish Head. However, high densities of shrimp were found at beam trawl stations located in the shallower southern portion of the selected site, and in nearby stations located outside the site. Shrimp densities at the two highest beam



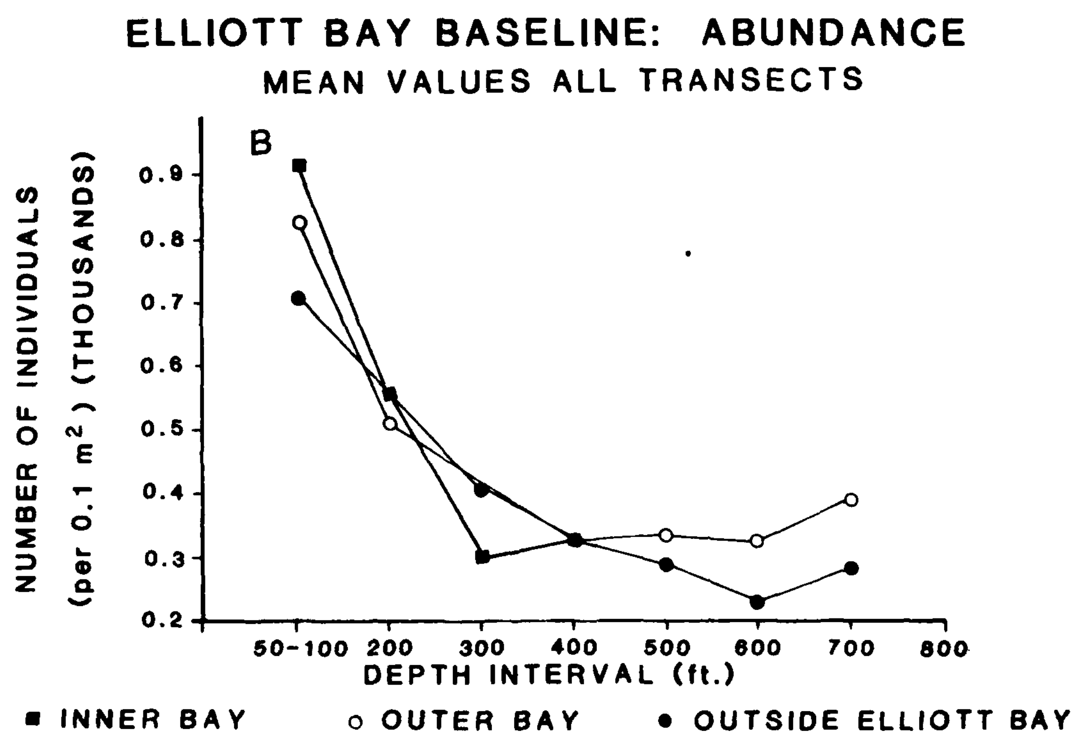


Figure 3.13 Depth related benthic faunal trends. Mean total A) taxa and B) abundance for each depth contour (Source: Word et al. 1984).

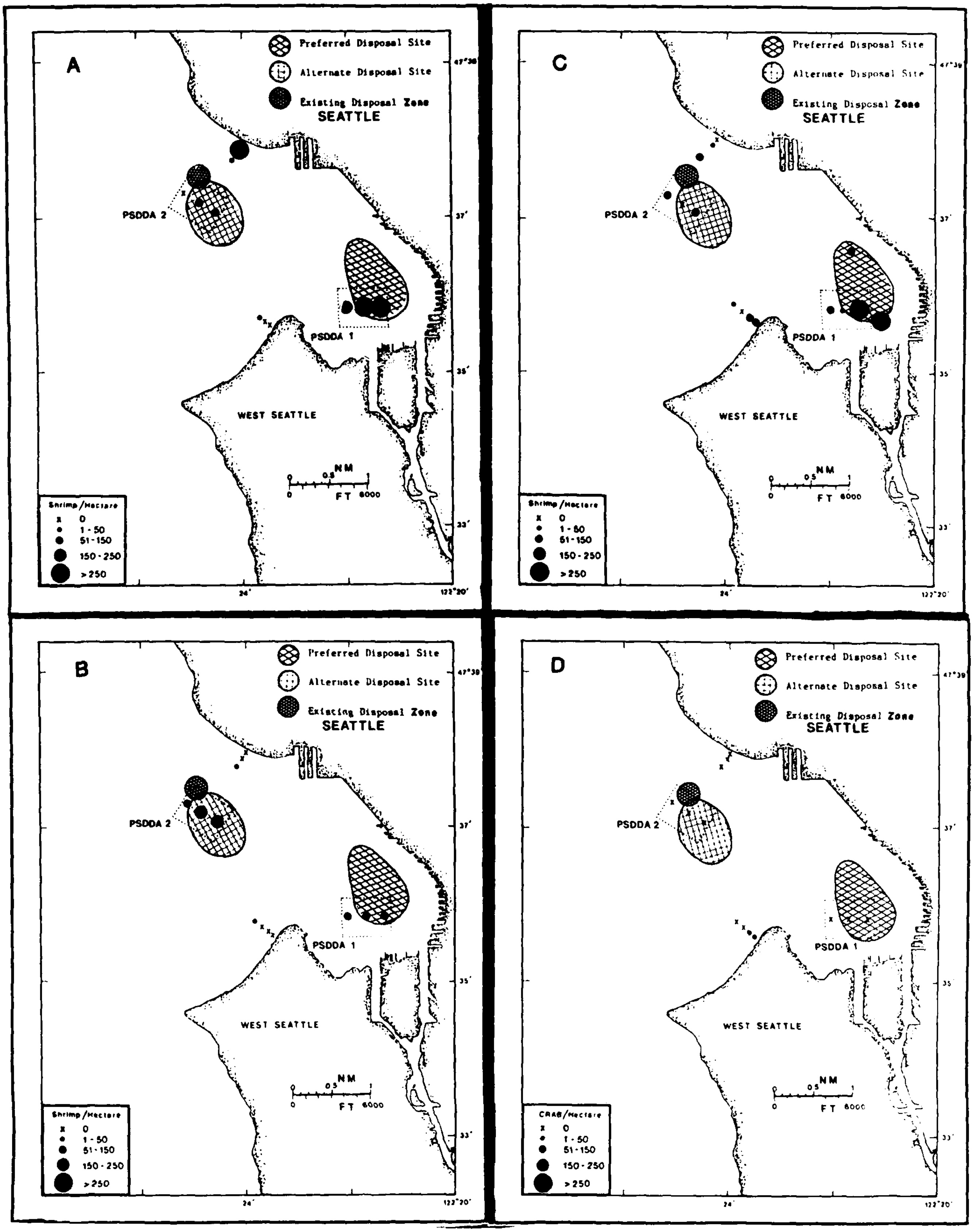


Figure 3.14 Elliott Bay Seasonal Shrimp Densities; A) February, B) June, and C) September 1986. Crab Densities; D) June 1986 (None found in February and September. Source Dinnel et al., 1986a)

trawl stations were 843 and 543 shrimp/ha, with an average density of 322 shrimp/ha at the site (figure 3.14c). Average densities at the Fourmile Rock alternate site were 44 shrimp/ha (figure 3.14c). Catches were dominated by pink shrimp (Pandalus borealis) with a few of the larger spot prawn (Pandalus platyceros) and side-stripe shrimp (Pandalopsis dispar) in evidence. The otter trawl was more efficient at catching shrimp, with average densities of 885/ha for the preferred site, and 80/ha for the alternate site. Otter trawl shrimp catches in Elliott Bay during September in the preferred and alternate (Fourmile Rock) sites were 4.8 and 0.6 kg/ha respectively.

The data suggest that the shrimp migrate into inner Elliott Bay during at least two seasons of the year, winter and fall. In general, shrimp densities were highest at the disposal sites compared to the nearshore reference sites, which is primarily a result of depth related partitioning of species. See section 3.02b(1)(c) (Commencement Bay) for a discussion of depth (figure 3.6) distributions for each species and their sizes.

Comparisons of all catch figures with estimated average shrimp catches (otter trawl) from Hood Canal and other areas of Puget Sound (table 3.2) indicate that the selected site has shrimp quantities that could support a limited commercial fishery. However, fishing there would be difficult due to high usage of the area by an Indian commercial fishery, high shipping activity and the presence of anchorage areas. The value of the shrimp for human consumption is suspect due to the potential for shrimp bioaccumulation of sediment contaminants (Word, et al. 1984; Stober and Chew, 1984). The main value of these shrimp stocks may be in supplying recruits to other areas of Puget Sound (Dinnel, et al., 1986a).

(2) Plankton Communities. Phytoplankton and zooplankton communities are generally ubiquitous throughout Puget Sound but exhibit tremendous spatial and temporal variations in species composition and abundances. The reader is referred to section 3.01b(2) for a general discussion on bloom periods and taxonomic/species succession.

(3) Anadromous and Marine Fishes. Elliott Bay provides both marine and estuarine environments for a variety of resident and migratory fish. Over 110 species are known to exist within the area. There is considerable information on anadromous and marine fish, especially in and around the Duwamish estuary, Pier 91, and at existing or proposed Metro sewage outfalls (U.S. Army Corps of Engineers, 1979, 1980, 1981; Port of Seattle, 1976, 1980a, 1980b, 1980c, 1981a, 1981b, 1982a, 1982b, 1982c; U.S. Fish and Wildlife Service, 1981; Metro, 1977; Buckley et al., 1984a, 1984b).

Salmonid species that migrate through the Elliott Bay/Duwamish estuary system include chinook (Oncorhynchus tshawytscha), chum (Oncorhynchus keta) and coho (Oncorhynchus kisutch) salmon, and steelhead (Salmo gairdnerii) and searun cutthroat (Salmo clarki) trout, as well as searun Dolly Varden (Salvelinus malmo). Pink salmon (Oncorhynchus gorbuscha) juveniles are also present in Elliott Bay (even numbered years only); however pink salmon originate from outside the bay.

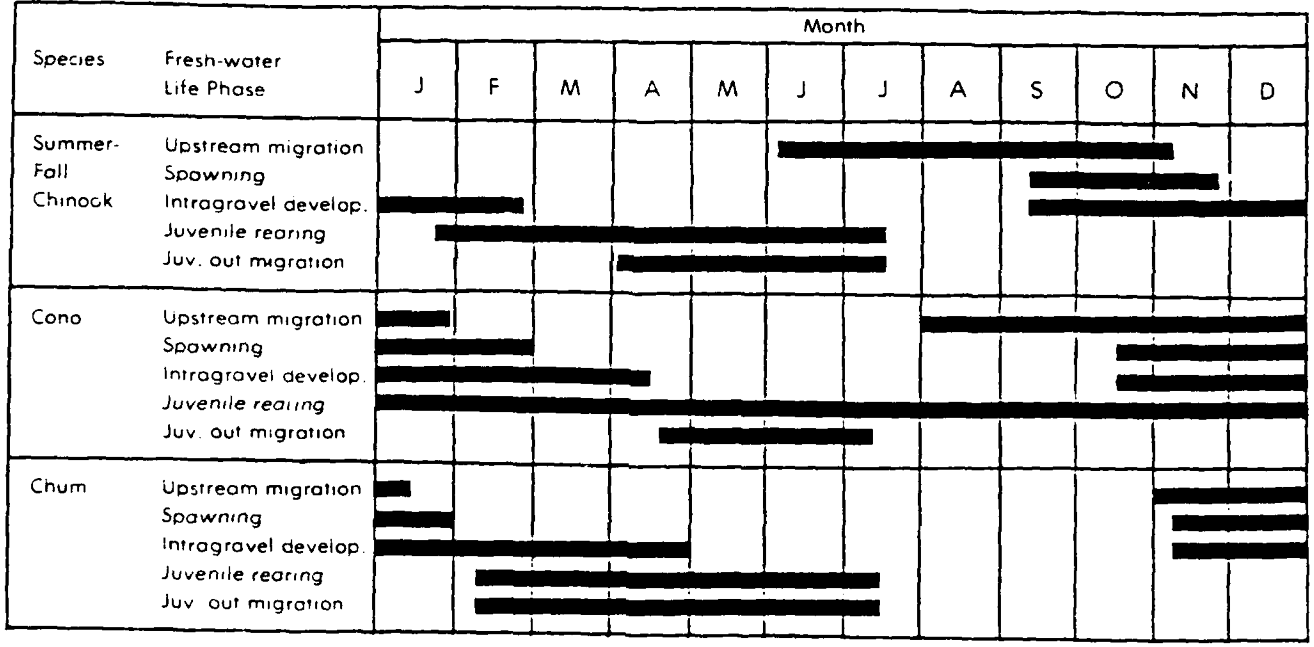
Relative to timing, adult salmonid migrations into the Green-Duwamish River system occur year-round, but mainly during the period from July through December. Juvenile outmigration from the Green-Duwamish system occurs principally from mid-February through mid-July, but small numbers of juveniles may outmigrate throughout the year. Temporal patterns of habitat utilization in the Green/Duwamish River system are shown in figure 3.15.

(a) Adult Salmonids. There are two races of chinook salmon, the spring-summer run and the fall run varieties. The spring run enters the Duwamish River in late May, whereas the fall run chinook begins in late June and continues through October and sometimes into November. The peak fall run occurs between August and October. Approximately 60 percent of the production results from artificial enhancement primarily from the WDF Soos Creek Hatchery, Muckleshoot Tribal Hatchery, and a sports fishermans co-op. Blackmouth (nonmigratory chinook) reside in the sound year-round. Total chinook escapement was estimated to be between 10,900 to 20,200 fish for the the period 1966-1971, averaging about 15,100 fish annually. The Green River Hatchery has documented as many as 31,729 adult returns since 1960, with an average return between 1966-1971 of 8,500 fish per year (Williams et al., 1975).

The coho spawning season begins in August and normally extends through December with peaks in September and October. The vast majority of these fish are hatchery produced. Total coho spawning escapements (natural plus artificial) to the Green-Duwamish River system were estimated to range from 15,900 to 64,000 fish between 1966 and 1971, averaging about 43,500 fish per year (Williams et al., 1975). The WDF hatchery on Soos Creek documented as many as 55,868 coho during a single season (Williams et al., 1975). The chum salmon run begins in early November and extends to late December or early January. Nearly 100 percent of these fish are hatchery produced, the majority originating from the Muckleshoot Tribal Hatchery. Chum salmon escapements are estimated to have ranged from 4,400 to 22,100 fish from 1966 to 1971, averaging about 11,300 fish per year during this period (Williams et al., 1975). Summer run Steelhead trout migration extends from April to July. The winter run migration begins in November, peaks in Jaunary, and extends to March or April. Sea-run cutthroat trout migrate upriver during the winter months, overwinter in fresh or estuarine waters after spawning, then outmigrate in early spring or summer. A greater percentage of their life history is spent in estuarine habitats then other anadromous salmonids. Dolly Varden migrations are local and occur between spring and summer. Their presence in Elliott Bay is incidental as the majority of the population is confined to freshwater.

(b) Juvenile Salmonids. The length of residency or time that juvenile salmonid fish remain in Elliott Bay and the Duwamish Waterway varies considerably among species and sampling areas. Meyer, et al. (1981), indicates that chinook and chum are present for the longest period, compared to other salmonids, in the lower Duwamish River. Coho and steelhead spend much less time in the estuary and move fairly rapidly to marine waters.

Figure 3.15 **Timing of salmon fresh-water life phases in Green-Duwamish Basin** (Williams et al. 1975)



Chinook juveniles are present in Elliott Bay from March to July with peak numbers from late May to June. They tend to concentrate along the shoreline during their early estuarine residence and later move offshore to feed. The majority of the juvenile chinook are derived from the Green River system. The majority from this system are from the Soos Creek Hatchery, although the Muckleshoot Tribe releases substantial numbers each year.

Coho salmon juveniles are found in Elliott Bay from late April to early June. Because they are yearlings they can utilize pelagic food sources and are able to move offshore and migrate rapidly out of the area. Most of these fish originate from the Soos Creek Hatchery.

Chum salmon populations are reduced due to predation on fry by hatchery reared juvenile coho, although other factors are also significant. The Muckleshoot Tribe plans to release several million fry each year. The juveniles are found in Elliott Bay from late April to June. Substantial numbers may originate in southern Puget Sound, where large runs still exist. As chum juveniles follow the shoreline extensively, those originating from south sound would be expected along the Elliott Bay shoreline.

No pink salmon run exists in the Green River. Pink salmon juveniles present in Elliott Bay most likely originate from southern Puget Sound rivers. Steelhead juveniles from the Green River system migrate rapidly through Elliott Bay and out of Puget Sound. Sea-run cutthroat juveniles occur only sporadically throughout the bay. Little is known about their life history and movements within Elliott Bay.

Food web elements have been particularly well-defined for the salmonids. Research from studies conducted elsewhere in Puget Sound suggests that chum salmon descending the Duwamish River begin feeding in the estuary on epibenthic prey. When they reach a length of 45-50mm, they tend to shift to pelagic prey. Chum salmon juveniles, in turn, may fall prey to predation by larger juvenile coho, steelhead, and sculpin. Juvenile coho and chinook have a more diverse diet spectrum. Their prey consists of riverborne insects, small crustaceans, and juvenile fish. They will also fall prey to larger fish, such as more mature salmon and trout (Dexter, et al., 1981; Salo, et al., 1980).

(c) Inshore Marine Fish. Marine fish life histories and distributions in Puget Sound are well described in several publications, most notably in Miller (1980). The most common species found along Elliott Bay shorelines are: shiner perch (*Cymatogaster aggregata*), English sole (*Parophrys vetulus*), rock sole (*Lepidopsetti bilineata*), flathead sole (*Hippoglossoides elassodon*), Dover sole (*Microstomus pacificus*), Pacific tomcod (*Microgadus proximus*), walleye pollock (*Thergra chalagramma*), quillback rockfish (*Sebastes maliger*), and Pacific staghorn sculpin (*Leptocottus armatus*) (Port of Seattle, 1976; Miller, 1980). The most common surface dwelling fish are herring and salmon species.

(d) Bottomfish Resources in the Disposal Sites. Bottomfish distribution and abundance at the preferred and alternate disposal sites were studied by the University of Washington School of Fisheries and Fisheries Research Institute during February, June, and September, 1986.

In February, bottomfish catches were generally small with the exception of 10 large Dover sole (Microstomus pacificus) caught near the alternate disposal site. In June, more bottomfish were caught at the preferred site than the alternate site. The average catch per trawl at the preferred site was 53 fish representing 15 species, compared to 15 fish per trawl and 7 species at the alternate site. Slender sole and blackbelly eelpout dominated the preferred site catches while slender sole and Dover sole dominated the alternate site catches.

In September, the catches at both disposal sites were larger than the catches during June. At the preferred site, the average catch per trawl was 59 fish representing 18 species, while at the alternate site, the average catch per trawl was 90 fish, representing 13 species. Dominant species at the alternate site were ratfish and English sole, while blackbelly eelpouts, slender sole, and flathead sole dominated the preferred site.

In general higher abundances of fishes observed at the preferred site are likely the result of the preferred site's relative shallowness and proximity to fresh water (Duwamish River). However, there are no significant populations of recreationally or commercially important bottom fishes either as juveniles or adults at either disposal site in Elliott Bay.

(e) Foodweb Relationships: BRAT Assessment of Bottomfish Feeding Habitat Values in Disposal Sites. The reader is referred to section 3.02b(3)(e) for an overview of the rationale and description of the BRAT analysis. Bottomfish feeding strategy groups identified through the BRAT field studies conducted by the Waterways Experiment Station during June/July 1986 are summarized in table 3.3 (see Clarke, 1986; DSI TA). Four feeding strategy groups were identified that appeared to be exploiting infaunal benthos heavily, and were primarily represented by Dover sole and English sole. Figure 3.16 illustrates the distribution and amount (g/m2-wet biomass) of potential benthic food available to each of the four feeding strategy groups at each site in Elliott Bay. Benthic resource values were generally similar between preferred and alternate sites for each feeding strategy group (table 3.4). Average benthic habitat food values ranged from a low of 12.1 g/m2 (Group IIA) to a high of 21.2 g/m2 (Group IIB) at the preferred site, and 13.5 g/m2 (Group IIA) to 24.0 g/m2 (Group IIB) at the Fourmile Rock alternate site. An examination of the diets of bottomfishes collected in Elliott Bay indicated that they were feeding predominately on polychaetes and bivalve molluscs, closely paralleling results previously discussed for benthic infaunal compositions (section 3.03b(1)(b)).

(4) Marine Mammals. All of the marine mammals found in Elliott Bay are migratory and have wide distribution patterns. Therefore, they are discussed in the regional setting section. The reader is referred to the regional marine mammals section 3.01b(4) for this discussion.

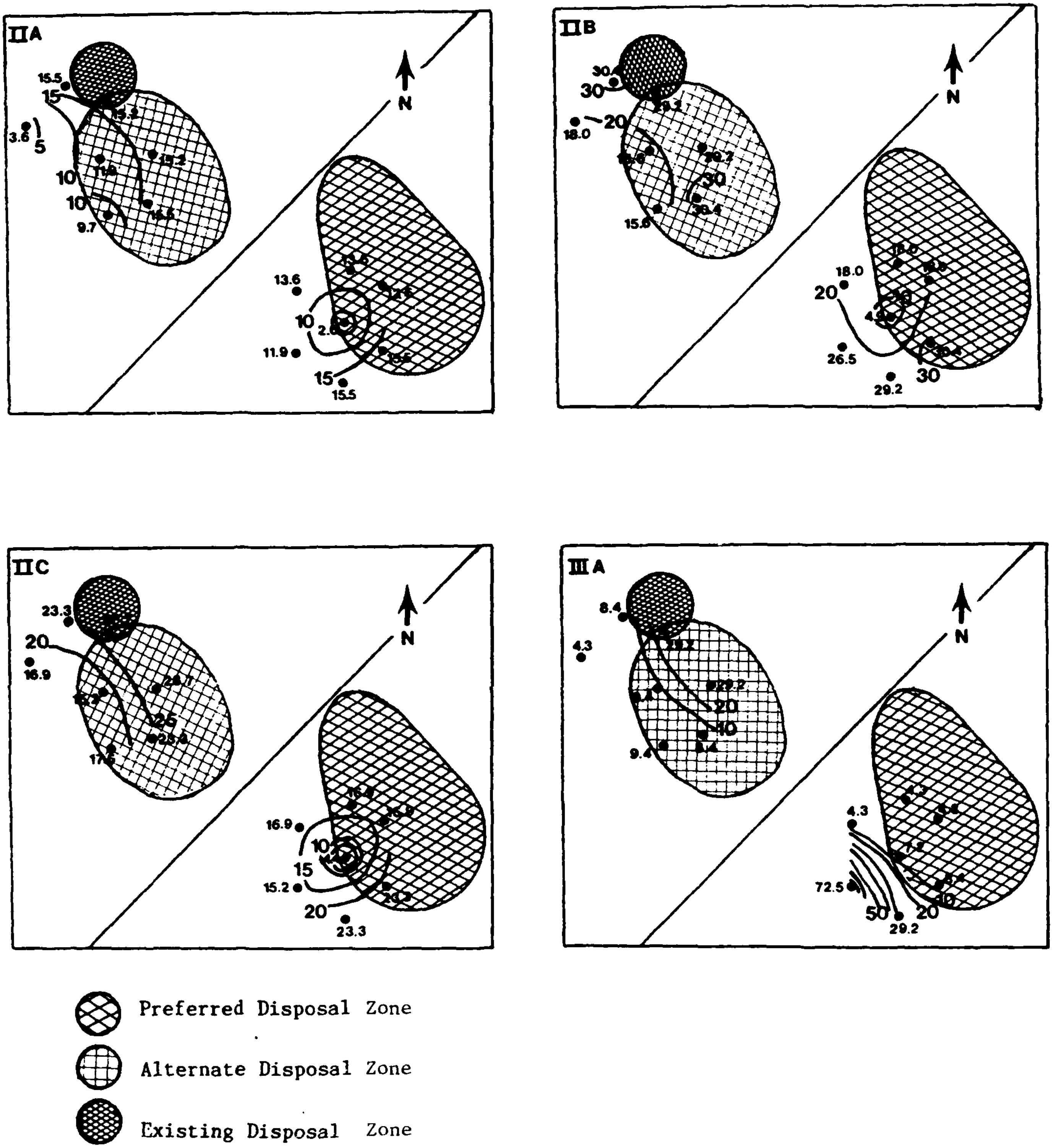


Figure 3.16 Benthic biomass potentially available in Elliott Bay to four groups of fish. Units of biomass are in grams per square meter (Source: adapted from Clarke, 1986)

(5) Water Birds. The open waters of Elliott Bay are generally noted as areas of significance for overwintering canvasbacks and greater scaups (Brunner, Ken, 1986, Corps; personal communication). Other common waterbirds include grebes, gulls, scoters, goldeneyes, and cormorants. These birds are also present, sometimes in large flocks, in Puget Sound off of West Point and Alki Point. Harlequin ducks are also occasionally present. Paralleling exposed shorelines and within the lower intertidal zone, loons red-breasted mergansers, horned grebes, and cormorants dive for fish. Frequently, these species are presumed to feed among kelp beds or along rocky bottoms over intertidal shelves. Few waterbirds nest near Elliott Bay. Three pairs of pigeon guillemots nest in the bank along the south bluff of Discovery Park. Other nesters include small numbers each of mallards, Canada geese, great blue herons, and glaucous-winged gulls.

Protected bays within and near Elliott Bay offer sanctuary to resting buffleheads, grebes, goldeneyes, and scoters in addition to providing feeding habitat. Shorebird use in Elliott Bay is low relative to Commencement Bay--there are few intertidal areas on which shorebirds can feed, or log rafts on which shorebirds can rest. The Duwamish Waterway is probably the best area in Elliott Bay for shorebirds; however, use of Duwamish habitats by shorebirds is low. Smith Cove is another intertidal area that receives shorebird use. In late summer, terns and gulls are common at the mouth of Shilshole Bay, where they feed on small fish and rest on pilings and log rafts.

(6) Endangered and Threatened Species. The nearest bald eagle nests to Elliott Bay are one on Bainbridge Island and at least one (and perhaps three) nest(s) along Lake Washington. Bald eagles are regularly sighted flying over or perching in trees in Discovery Park. Bald eagles are present in the area throughout the year, though they are relatively uncommon.

Peregrine falcon sightings in the Elliott Bay vicinity are rare. There is no good habitat or prey base for peregrines in this area.

Gray whales are regularly observed near Elliott Bay (Everitt, et al., 1979). They do not stay in a particular location for long, though they appear to stay in Puget Sound for extended periods. It is not known whether these stragglers eat while in Puget Sound.

Humpback whales were once commonly sighted in Puget Sound, but sightings have been rare since the 1940's. Two sightings have been made in recent years near Elliott Bay, one in 1976 and one in 1978 (Everitt, et al., 1979). The first sighting was of two animals that were breaching and observed from the Seattle-Winslow ferry. The second sighting was of four animals observed from Fauntleroy. Though these sightings are hopeful, a comeback to historic numbers by this species is considered remote and more than occasional sightings are not expected.

The BA's prepared for the PSDDA Phase I study area are attached in exhibit A. More detailed descriptions of the Elliott Bay threatened and endangered species, and their habitat, are provided in the BA's.

c. Human Environment.

(1) Social Economic. The primary dredging areas that would use the Inner Elliott Bay unconfined open-water disposal site include portions of Kitsap County, most of King County, and the cities of Seattle, Bremerton, and Port Orchard. King County is the largest county in the State with a population of 1,346,400 in 1985. Population growth over the last decade has been due to a variety of economic factors including expansion by Boeing and establishment of high-technology companies. Population forecast by the Washington State Office of Financial Management show the population of King County increasing to 1,601,700 by the year 2000. Major port redevelopment continues to occur along Elliott Bay and along the lower Duwamish River. Waterborne commerce through Seattle Harbor has increased from 15,008,000 short tons in 1975 to 20,300,000 short tons in 1984.

(2) Navigation Development. The lower 6 miles of the Duwamish River basin is the center for manufacturing distribution and port activity in metropolitan Seattle. About 7,000 acres of highly industrialized former tideflat area were developed in the early 1900's due to their proximity to the Seattle central business district. Other areas, located at both the south and north ends of Elliott Bay and extending over 2.5 miles of waterfront, have also been developed to accomodate waterborne commerce. Virtually all of the historical wetlands existing in Elliott Bay have been modified through development (table 3.5).

The existing Duwamish River waterways, all federally maintained, are described below:

- East Waterway. This channel, approximately 1.1 miles long and 750 feet wide, is maintained to a depth of 34 feet below MLLW.

- West Waterway. The West Waterway has the same authorized width and depth as the East Waterway but is about 1 mile in length.

- Duwamish Waterway. Beginning at the confluence of the East and West Waterways, the Duwamish Waterway extends upstream about 5.1 miles to the head of commercial navigation. Depths and widths vary as follows:

	Depth (feet below MLLW)	Width (feet)
West Waterway to 1st Ave South Bridge	30	200
1st Ave South Bridge to 8th Ave South Bridge	20	150
8th Ave South Bridge to Head of Navigation	15	150

(3) Dredging and Disposal Activity.

(a) Historical Activity (1970-1985). During the period 1970-1985, approximately one-half of the dredging activity that occurred in the Phase I study area took place in Elliott Bay and vicinity. Dredged material amounted to approximately 8.4 million c.y. (table 3.6). Most of this material was placed in nearshore disposal sites, although the Fourmile Rock open-water disposal site was heavily used in the late 1970's and 1980's (aproximately 4.6 million c.y. disposed at this site).

The largest amount of dredging (54 percent of total) in Elliott Bay and vicinity over the 1970-1985 period was undertaken by diverse interests including private developers, municipal governments, State agencies, and the U.S. Navy. During this time the Corps dredged aproximately 2.2 million c.y. (26 percent of total activity) and the Seattle Port approximately 1.7 million c.y. (20 percent of total activity).

(b) Projected Activity (1985-2000). Over 10.5 million c.y. of material are forecasted to be dredged in Elliott Bay and vicinity over the period 1985-2000 (table 3.7). This includes Elliott Bay, the Duwamish River, Lake Union, Lake Washington, as well as the western side of Puget Sound including Eagle Harbor and Sinclair Inlet. The majority of the sediment to be dredged is estimated to come from the Duwamish River (71 percent of total).

Unlike Commencement Bay where the Corps is projected to dredge 68 percent of the material, Corps dredging activity in the Elliott Bay area will account for only 40 percent of the total forecasted dredging volume. Most of the dredging in the Elliott Bay and vicinity will be undertaken by the Port of Seattle and others.

(4) Native American Treaty Fishing. The Muckleshoot and Suquamish Tribes have utilized Elliott Bay for a significant amount of their fishing effort. In addition, the Lummi, Tulalip and Swinomish Tribes also fish in the Elliott Bay area, and the Yakima Tribe additionally possess rights they could propose to exercise in the future. Fishery activity of the unrecognized Duwamish Tribe has not been documented.

Although the combined "usual and accustomed" fishing areas of the tribes encompass a large area, salmon fishing has generally focused in a few locations. Reasons for this include concentration of returning fish populations, suitable fishing conditions and limited interference from recreational and commercial traffic. Both of the alternative Elliott Bay disposal sites occur within areas of concentrated tribal fishing activity. (There is also an extensive commercial Indian fishery in Lake Washington and the Green/Duwamish River system.)

Tribal fishery in Outer Elliott Bay (that portion of the bay west of a line from Terminal 91 to Duwamish Head, and east of a line from West Point to Alki Point) can open from 1 July, and remain open until approximately 30 November each year. During this time, fisheries open and close for chinook, coho and

chum salmon, and steelhead trout, depending on run sizes, timing, and other management constraints. These tribal fishery openings and closure periods vary from year to year. Tribal fishery managers are required to notify the Washington Department of Fisheries of fishing openings and closures at least 24 hours in advance.

In Inner Elliott Bay (that portion of the bay east of a line from Terminal 91 to Duwamish Head) the tribal fishery also can open around 1 July. Here, it can remain open until approximately 30 January. As in outer Elliott Bay, the fisheries open and close to accommodate the management of individual stocks of fish entering the bay, and specific openings and closure periods vary from year to year.

The July chinook fishery has primarily been an evaluation fishery, used to set allocations for the intensive fishery that has begun in August. This fishery usually peaks in August and ends in early September. The coho fishery usually starts (and peaks) in September, tapering off somewhat in October. This latter fishery has represented the bulk (as much as 60 percent of the Muckleshoot catch) of the value of the tribal commercial catch.

In the Duwamish River, the tribal salmon fishery has opened around 15 July and closed around 30 November. It usually opens again around 1 December for the commercial steelhead fishery, lasting until around 1 February. The tribal steelhead subsistence fishery has typically been open throughout the year, depending on the availability of harvestable summer-run steelhead.

When fisheries open, they remain open 24 hours per day until closed. To improve catch success, a large portion of the fishing effort occurs between dusk and dawn. The number of days of fishing is adjusted according to the estimated number of harvestable fish and expected fishing effort.

Tribal fishing can occur throughout Elliott Bay; however, their fishing efforts may be focused at different locations within the bay depending on the behavior of the species being targeted. For example, the chinook fishery effort has often occured close to the shoreline, whereas the coho effort has generally been located offshore and is more dispersed throughout the bay. The only area that has not been routinely fished is that used by the Washington State Ferry System. The ferry lanes are typically avoided to minimize conflicts between boats and fishing gear.

Tribal regulations currently prohibit fishing within a 1,000-foot radius from both the East and West Waterways. The closure is designed to provide relief to milling nontarget species, as well as to minimize boat traffic and fishing gear conflicts. One of the more concentrated areas of tribal fishing activity in inner Elliott Bay is the area north of the mouth of the Duwamish Waterways, outside of the regulated 1,000-foot closure areas. The PSDDA selected disposal site for Elliott Bay begins 2,500 feet from the mouth of the waterways, and thus is within this high-use tribal fishing area (figure 3.10). The surface disposal zone is near the center of the disposal site, beginning about 4,000 feet from the mouth of the waterways. However it, too, is still within the area of higher tribal fishing activity.

(5) Non-Indian Commercial and Recreational Fishing. Elliott Bay supports a number of non-Indian commercial and recreational fisheries activities. The following summary is based on the latest WDF catch statistics for 1985-1986 (Dale Ward, personal communication, WDF, 1987). In 1985, total sport catches of chinook and chum salmon for Seattle-Bremerton were 33,019 fish. Comparative commercial catches of salmon were much smaller, totalling 3,679 fish in 1986. Bottomfish catches consisting of true (Pacific) cod, English sole, and rockfish totaled 44,486 pounds in 1986 for Elliott Bay and Bremerton collectively. WDF reported catches totalling 1,208 pounds for herring and 28,059 pounds for surf perch (shiners) for Seattle and Bremerton collectively in 1986. A limited commercial fishery for spot shrimp has existed in Elliott Bay, although harvests of spot shrimp have been very low in recent years (Magoon, 1977). No other shellfish species are harvested commercially from the bay.

(6) Esthetic Setting. The esthetic setting in Elliott Bay is primarily the bay itself, the boat traffic in the bay, and the background islands and Olympic Mountain range. This setting can be viewed from the city shoreline, from Magnolia tidelands to Duwamish Head, from the bluffs and hills of Magnolia, Queen Anne, Capitol Hill, and West Seattle, from the Harbor Island industrial area, and from tall buildings in the central business district. Public access to the shoreline areas includes a small city park near Piers 90/91, Myrtle Edwards Park north of Pier 70, the city waterfront, and the sidewalks near Duwamish Head in West Seattle.

3.04 Port Gardner.

a. Physical Environment.

(1) Geology. Figure 3.17 shows the location of the existing DNR disposal site and the selected and alternate sites in Port Gardner. Figure 3.18 shows the location of the alternate disposal site proposed in Saratoga Passage. Port Gardner is located regionally in the Puget Sound Lowlands Geomorphic Province, which is a complex topographic and structural basin that formed 2 to 3 million years ago (Hart Crowser and Assoc., Inc., 1986). The lowlands have subsequently been repeatedly glaciated, resulting in the accumulation of a thick sequence of overconsolidated and unconsolidated sediments. The bedrock surface under these deposits varies considerably in relief, but is estimated to be about 1,600 feet below the ground surface (Hart Crowser and Assoc., Inc., 1986).

Quaternary age sediments mantle most of the Puget Lowlands and bedrock, and are the product of deposition during repeated continental glacial ice advances and intervening nonglacial periods. Deposits consist of stratified and unstratified layers of clay, silt, sand, gravel, and cobbles. Ice from the most recent glacial advance, known as the Fraser Glaciation, occupied the Puget Lowlands 11,000 to 13,000 years ago. Ice at this time is believed to have reached a thickness of 3,500 to 4,500 feet in Port Gardner. Consequently these deposits are highly compacted by the weight of the glacial ice, and are described as "overconsolidated glacial sediments" (Hart Crowser and Assoc., Inc., 1986).

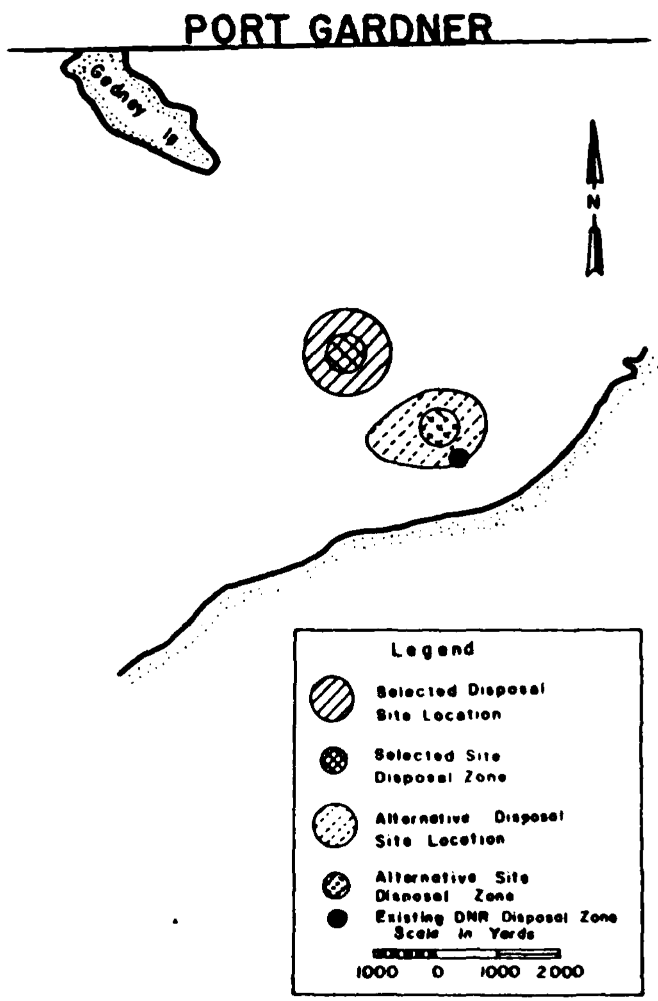


Figure 3.17 Alternative Port Gardner Disposal Sites

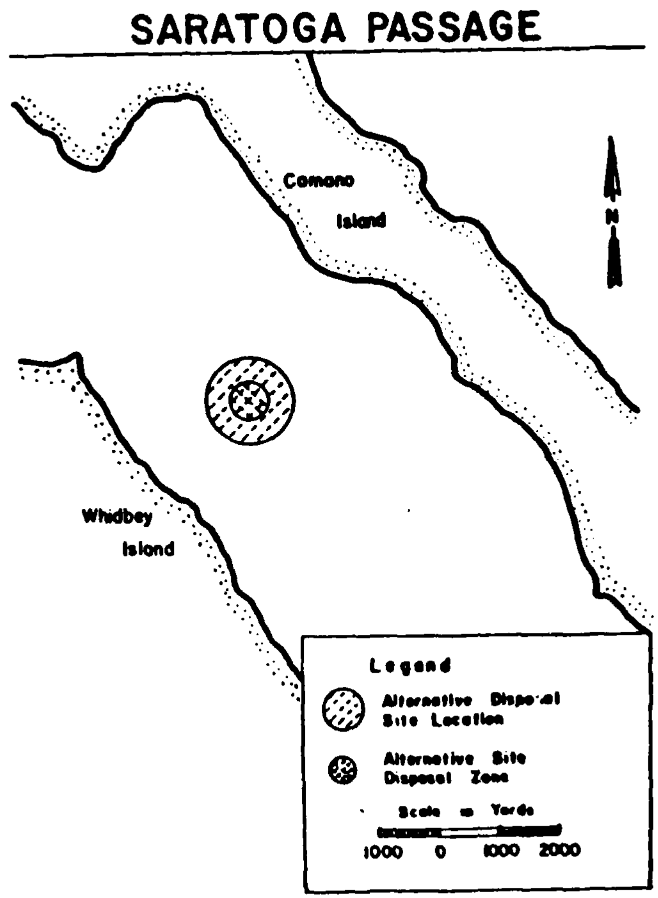


Figure 3.18 Saratoga Passage alternate site

Delta sediments supplied from the Snohomish River overlie the overconsolidated glacial material in the East Waterway, and the depth of these normally consolidated soils ranges from 20 to 30 feet to over 150 feet. The area in the vicinity of the PSDDA alternate site extending to the selected site is generally overlain by 10 to 40 feet of deltaic silt, followed by an underlying sandy silt layer with an apparent thickness of between 10 and 80 feet. The soil below the deltaic sandy silt is undifferentiated glacial and nonglacial deposits (Corps, 1986).

(2) Water Quality. Marine waters at Port Gardner are classified by Ecology as Class A ("excellent") with waters in East Waterway classified as Class B. At the present time however, Port Gardner is closed to shellfish harvesting due to elevated coliform and toxic pollutant levels. Recent water quality data is available from a Ecology sample station at Port Gardner (Station PSS 008). Water quality data from station PSS 008 indicates a temperature range of 8.6 degree C to 17.5 degree C with a mean of 12.8 degree C. Surface salinities range from 15.4 ppt to 30.3 ppt with a mean of 26.5 ppt. Minimum salinity values are observed during periods of maximum freshwater runoff during late spring and early summer, when surface waters in Port Gardner are influenced by the Snohomish River, and where salinities range from 0.1 to 23.7 ppt.

Dissolved oxygen standards set by Ecology allow DO levels to be lowered no more than 0.2 ppm through anthropogenic activity, with a minimum of 5 ppm (mg/l) minimum. Ecology data indicate DO ranges from 5.2 to 13.1 mg/l at Port Gardner during the year, averaging 8.2 mg/l.

The pH in Port Gardner ranges from 7.1 to 8.3 throughout the year (Ecology, 1984). State standards allowable for Class B waters are 7.0 to 8.5 with a variation allowance of 0.5 due to anthropogenic activity.

As with other classes of water, concentrations of toxic or deleterious material shall be below those which cause acute or chronic conditions. Provided, however, that within established dilution zones water quality criteria shall not apply, but dilution zones will be restricted in area and will be limited to not cause acute conditions.

Little information is available on distribution and concentration of trace metals in the water column at Port Gardner. In 1976, the Corps collected water samples from East Waterway, demonstrating measurable concentrations of cadmium, chromium, lead and arsenic (Corps, 1976). In 1985, the Corps collected samples from the East Waterway which were analyzed for chemicals of concern. All parameters were below detection limits in the site water except for Cu, Ni, Cd, Cr and Hg. The site water equaled or exceeded EPA Water Quality Criteria (EPA, 1986) for Cu, Ni, and Hg in marine waters. Samples were collected from near bottom waters, and may have been contaminated with suspended sediments. Thus, these samples are probably not representative of open waters in Port Gardner. Historically, high sulfide levels have been recorded due primarily to waste water discharges from two pulp mills in the

area. One is now regulated by a NPDES permit and the other has ceased operation. Sulfide levels continue to decline as a result of these changes in pulp mill operation.

Water quality data from Ecology (collected in 1982) indicate fecal coliform counts exceed standards in Port Gardner during periods of high rainfall. Consequently, shellfish harvesting is not permitted in Port Gardner. Samples collected for U.S. Navy Homeport studies in Everett indicated that high levels of fecal coliforms occurred in East Waterway during periods of essentially no rainfall.

Probable contaminant sources to Port Gardner are industrial discharges, sewage effluent, combined sewer overflows, and from nonpoint sources such as storm water runoff and discharges from recreational and commercial vessels. According to Puget Sound Water Quality Authority (1986), point sources are clustered in industrialized urban areas. There are many permitted discharges into Port Gardner and an unknown amount of effluent enters from unpermitted sources.

(3) Currents and Sediment Transport. The prevailing flow in Port Gardner merges with the southward flowing surface layer and the northward flowing bottom layer found in Saratoga Passage. However, few data records are available with which to document these patterns.

In the shallow surface layer, on the order of 10 meters (30 feet) deep, the discharge from the Stillaguamish and Snohomish rivers generally flow southward so as to merge with the shallow outflow from Saratoga Passage. Based on the available data, the prevailing direction of surface and midwater currents in central Port Gardner is toward the southwest.

The deeper layer originates offshore of Mukilteo and separates into two branches: the main branch continues northward into Saratoga Passage, and a minor, weak branch diverges eastward into Port Gardner. The flow continues counterclockwise following the bottom contours around Port Gardner. The prevailing flow of near-bottom currents in central Port Gardner is therefore estimated to be northward and westward. Current measurements at the Port Gardner disposal site, at the selected PSDDA site near the center of Port Gardner and at the proposed Navy CAD site all indicate that near-bottom current speeds rarely exceed 25 cm/sec and that the average speeds are a sluggish 4-8 cm/sec.

(4) Marine and Estuarine Sediments. The primary source of suspended sediment in Port Gardner is the Snohomish River. Annual sediment discharge is approximately 346,000 c.y. (Downing, 1983). The predominant sediment type found in most of the Port Gardner ZSF was medium and fine silt with the percent clay greater than 15 percent. Sediments along the south and east ends of the ZSF were coarser ranging from fine to very fine sand.

Sediment samples collected from East Waterway and vicinity have demonstrated the presence of significant concentrations of various toxicants such as

saturated hydrocarbons, aromatic hydrocarbons and polychlorinated biphenyls, which have degraded the water quality in this area (Crecelius, et al., 1984).

Sediments in the Saratoga Passage ZSF were predominantly medium to fine silt, whereas sediments along the margins of Camano and Whidbey islands consisted of fine sand. Percent clays were generally greater than 15 percent within the ZSF.

Studies by Battelle (1986) indicate that sediment quality was lowest in the East Waterway and increased moving outside of the East Waterway toward the PSDDA selected and alternate sites. Sediment quality indicators studied showed loading primarily by organic chemicals and toxic biological responses, thereby confirming the presence of degraded sediments throughout the Port Gardner nearshore area (1986).

(5) Air Quality. The following summaries are based on the PSAPCA Air Quality Data Summary for Port Gardner in 1985. CO measured at the single Everett station did not exceed the eight hour average standard. Lead was not measured in the Everett area during 1985. Relative to sulfur dioxide there were two incidents where standards were exceeded at the single Everett station. There are no ozone stations in the Port Gardner region as high ozone values exist some distance downwind of Everett. Nitrogen dioxide levels measured in the Puget Sound area have never exceeded the 0.05 ppm standard. Suspended particulate measurements at the solitary station did not exceed the primary standard (75 micrograms/cubic meter).

The Pollutant Standards Index (PSI), a nationally uniform index for daily air quality reporting, associates pollutant levels in a 24 hour period with potential health effects. When the PSI is above 100 the measured pollutant level (of CO, suspended particulates, and/or sulfur dioxide) exceeds the national primary air quality standard. For Port Gardner/Everett PSI was exceeded on only one day during 1985.

b. Biological Environment.

(1) Benthic Communities.

(a) Nearshore Intertidal/Shallow Subtidal Habitats. Little macrophytic growth occurs in the East Waterway due to long term water quality degradation and a minimum of suitable substrate, which occurs either under pier aprons (with little available light) or as creosoted wood pilings (a biocide). Riprap along the breakwater and along the Snohomish River mouth is inhabitated by *Fucus* sp. and *Ulva* sp. South of East Waterway and along the east shoreline, occasional rocks support *Enteromorpha* sp., *Bryopsis* sp., *Fucus* sp., and *Ulva* sp. The Snohomish River delta associated with Jetty Island is an extensive and productive mudflat inhabited by luxurient and extensive population of eelgrass (*Zostera marina*). This area provides important habitat for a variety of fish and invertebrates, including herring and Dungeness crab resources. Infauna are dominated by polychaetes (Sabellidae), oligochaetes,

while infauna include the important salmonid food resource Corophium salmonis. Several other species no doubt are present seasonally. For a list of potential species refer to U.S. Navy DEIS, Appendix B (1984).

The benthic invertebrate community in the East Waterway is dominated by polychaetes (77 percent) and crustaceans (21 percent) (Malkoff, 1976). From pier 3 south along the eastern shoreline, at least 25 polychaete families have been identified, with Captitellidae dominating (personal communication Striplin, 1987). Ostracods and amphipods dominant the crustacean population, and over 20 species of bivalve molluscs are present (Kisker, 1976). The intertidal community south of the old Weyerhauser Pulp Mill represents primarily sand and gravel habitat with occasional rock bulkheads. Attached organisms consist of mussels and barnacles. Beach epifauna include several species of amphipods, isopods, and bivalve molluscs. The latter are dominated by Macoma inconspicua.

(b) Benthic Communities - Selected Site and Alternate Sites (Port Gardner and Saratoga Passage). Site specific benthic studies were conducted by the Waterways Experiment Station in Port Gardner and Saratoga Passage during June 1986 (see Clarke 1986; DSS TA). These studies were conducted as part of the BRAT (Benthic Resources Assessment Technique) evaluation of demersal fish feeding habitat potential. The reader is referred to section 3.04b(3)(e) for a discussion of the results of the fish feeding habitat analysis. The selected and alternate sites in Port Gardner are situated in a relatively uniform, homogeneous area with grain sizes characterized as medium silt and clay contents greater than 15 percent.

Infaunal biomass observed at the Port Gardner selected site and alternate site averaged 36 g/m2 and 61 g/m2 respectively (i.e., within the 0-15 cm sediment fraction), compared to an average of 7 g/m2 at the alternate site at Saratoga Passage. In general benthic infaunal communities in Port Gardner were dominated by large polychaetes (Maldanidae, Terebellidae, Onuphidae) and bivalve molluscs (Axinopsida and Macoma). Large numbers of recruiting juvenile ophellid polychaetes were also observed in Port Gardner during June 1986 (Personal Communication, Ward, 1986) Depressed infaunal biomass at Saratoga Passage was not typical of that observed at the other three study areas. Benthos at this location was not dominated by polychaetes and bivalves typical of the other areas, but showed relatively low but uniform biomass distributions of polychaetes, bivalves, crustacea (ostracods, cumaceans, amphipods), and other taxa. Occasionally collected but not abundant taxa observed in all study areas were the relatively large individual biomass holothuroids (Malpadia sp.), echinoids, and the mudshrimp (Axiopsis spinulicauda). These larger species were observed typically deeper than 15 cm in the sediments. At the preferred site polychaetes comprised 50 percent of the biomass, molluscs (bivalves) made up 42 percent, whereas crustaceans comprised only 2.4 percent of the total. At the Port Gardner alternative site polychaetes made up 18 percent, molluscs (primarily bivalves) comprised 30 percent, and crustaceans made up less than 1 percent of the total. At the Saratoga Passage alternate site polychaetes made up 31 percent of the total biomass, molluscs (bivalves) comprised 14 percent, and crustaceans made up 12 percent. Variations in biomass distribution among stations reflect the patchy distribution of benthos

typically documented in benthic investigations (Johnson 1972; Rhoads, McCall and Yingst 1978; Kendall 1983) (figure 3.19). Depth partitioning of benthos (i.e., within the sediment core collected) at each station indicates that most of the biomass is concentrated within the upper 10 centimeters of the sediment, generally within the upper 5 centimeters (figure 3.4).

REMOTS investigations of the Port Gardner and Saratoga Passage ZSF's supported the box core sampling results and indicated both areas were predominately occupied by stage III communities with secondary occupations by stage I infaunal communities at the sediment surface (SAIC 1985; Cooper Consultants, Inc., 1986; DSI TA). Mean RPD depths in excess of 10 cm coincided with the presence of large, mature deposit feeding benthos (stage III) actively reworking the upper 10 centimeters of sediment.

(c) Crab and Shrimp Resources. An assessment of Dungeness crab (*Cancer magister*) and pandalid shrimp species distribution and abundance in Port Gardner was conducted in February, April, June, and September, 1986, and in December 1986/January 1987 by the University of Washington (Dinnel, et al., 1986a-e, 1987). This assessment was performed for the U.S. Navy as part of their required Everett Homeport Study and was also used by Corps in preparation of the supplement to the Navy's EIS.

The main objective of the crab and shrimp studies was to document the presence and/or absence of crab and shrimp and their relative abundance compared to other areas. Dungeness crab, for instance, have been shown to aggregate in certain areas relative to size, molting, and egg-bearing (Armstrong, et al., 1986); some of these areas being deep water habitats (Dinnel, et al., 1985). Selection of these habitats may be partially dependent on substrate type for food or for burial to avoid predation, especially during molting or egg-carrying.

During February, a high abundance of Dungeness crab, especially gravid females were found throughout a major portion of Port Gardner. However, they were not evenly distributed throughout the sampling area and their distribution varied according to sex and reproductive state for the females. Male crab were found almost exclusively in shallow water areas (98 percent were found in water less than 40 meters in depth) (figure 3.20a). In contrast, gravid females were found at deeper depths (73 percent recovered from depths of 40 meters or greater) (figure 3.21a). No crabs were observed in the selected site in February, and in the alternate site only small numbers of gravid females (19 hectare) were found (one transect). The selected site boundary was approximately 0.75 nmi miles from stations that exhibited substantial numbers of gravid females, but the alternate site boundary was located within 0.25 miles of stations with high concentrations of gravid females. No crabs were caught at the Saratoga Passage sampling stations.

In April, the highest crab densities occurred in the eastern portion of Port Gardner. Crab densities were highest in the 0-80 meter depth range, with females most abundant in the 40-100 meter range and males most abundant in shallow water (figures 3.20b and 3.21b). Males comprised only 8 percent of

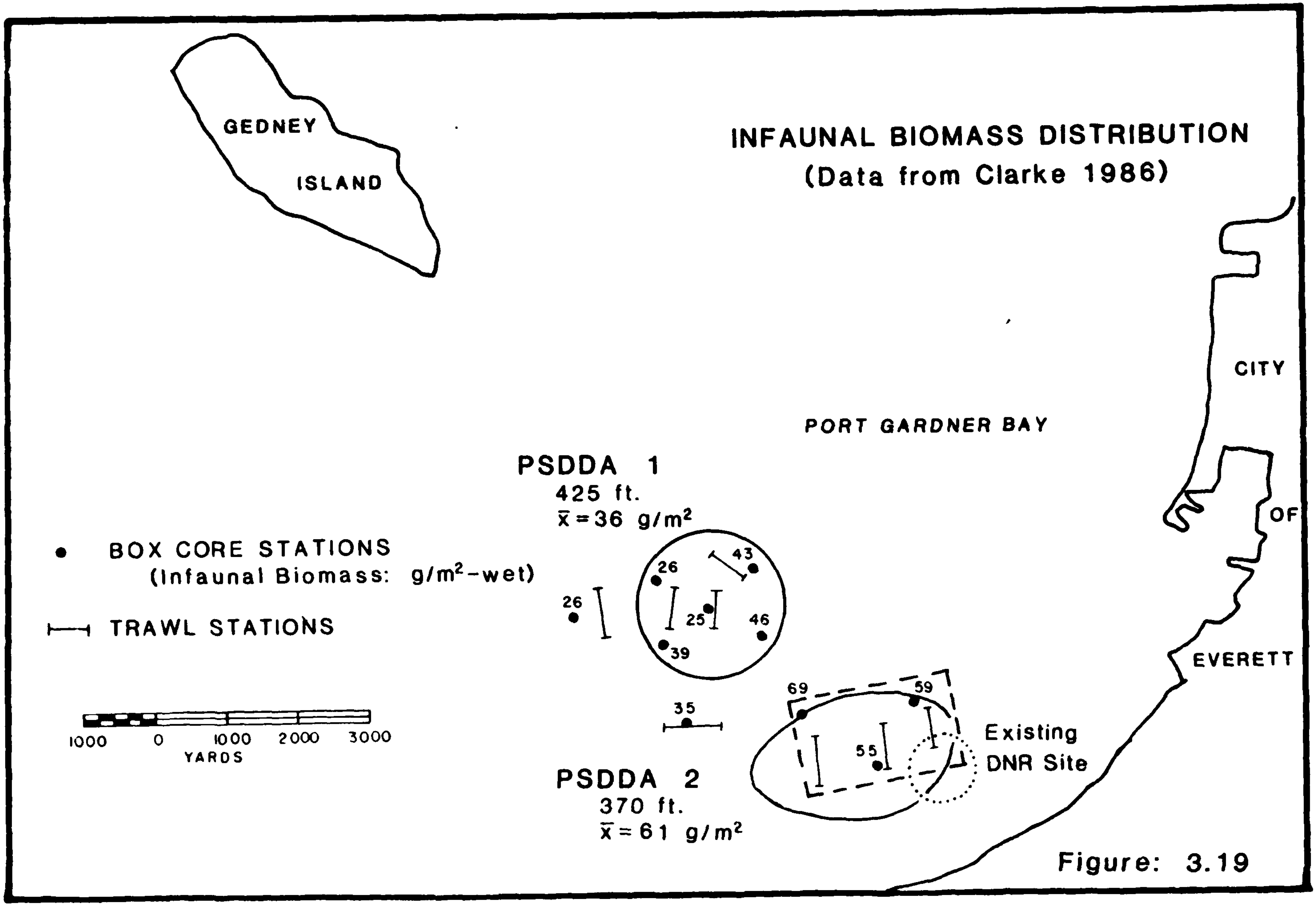

INFAUNAL BIOMASS DISTRIBUTION
(Data from Clarke 1986)
GEDNEY
ISLAND
PORT GARDNER BAY
CITY
OF
EVERETT
PSDDA 1
425 ft.
$\bar{x} = 36$ g/m²
PSDDA 2
370 ft.
$\bar{x} = 61$ g/m²
26
26
43
25
46
39
35
69
59
55
Existing
DNR Site
BOX CORE STATIONS
(Infaunal Biomass: g/m²-wet)
TRAWL STATIONS
1000
0
1000
2000
3000
YARDS

Figure: 3.19

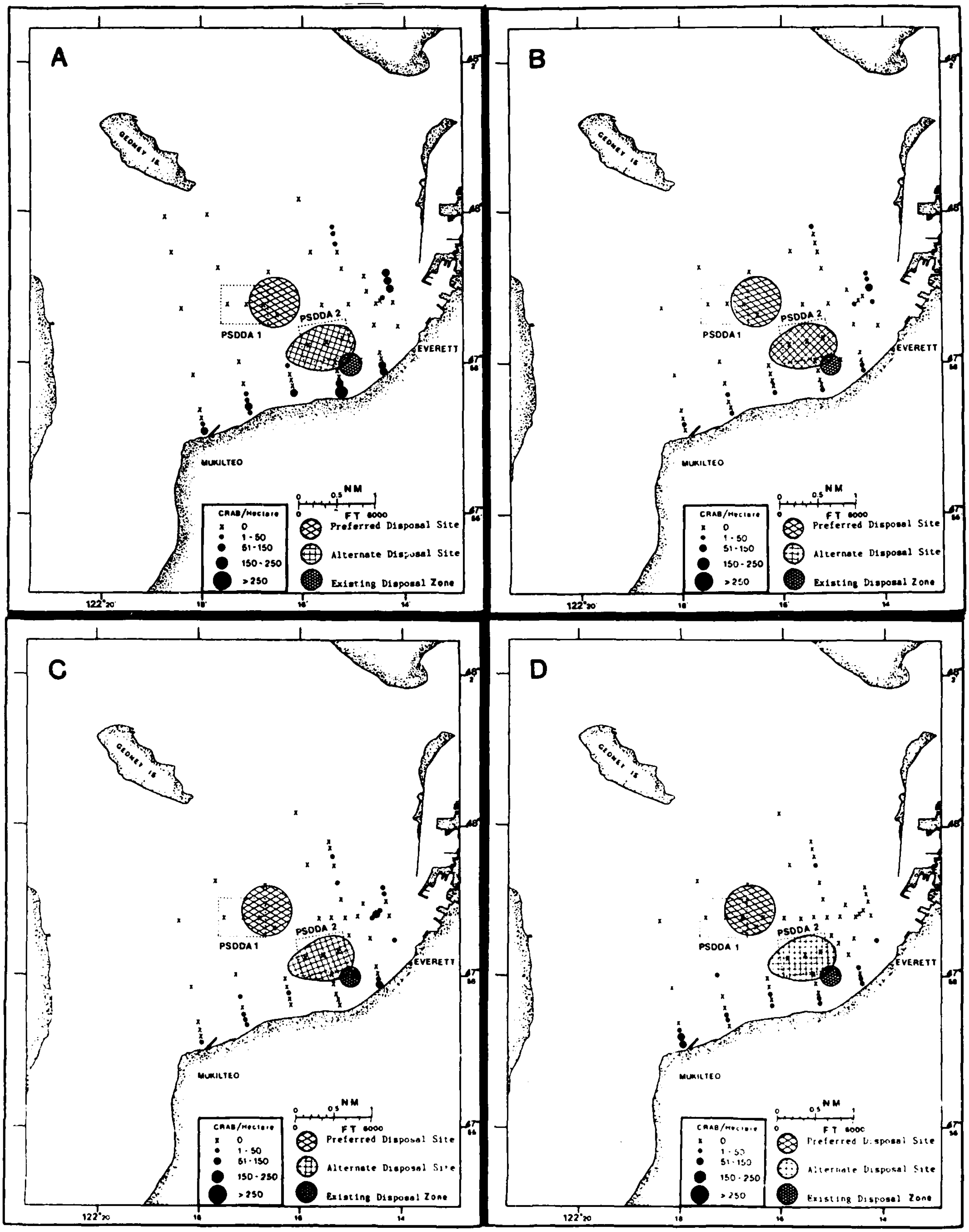


Figure 3.20 Port Gardner male crab density for: A) February, B) April, C) June, and D) September 1986; beam trawl. (Source: adapted from Dinnel et al., 1986a)

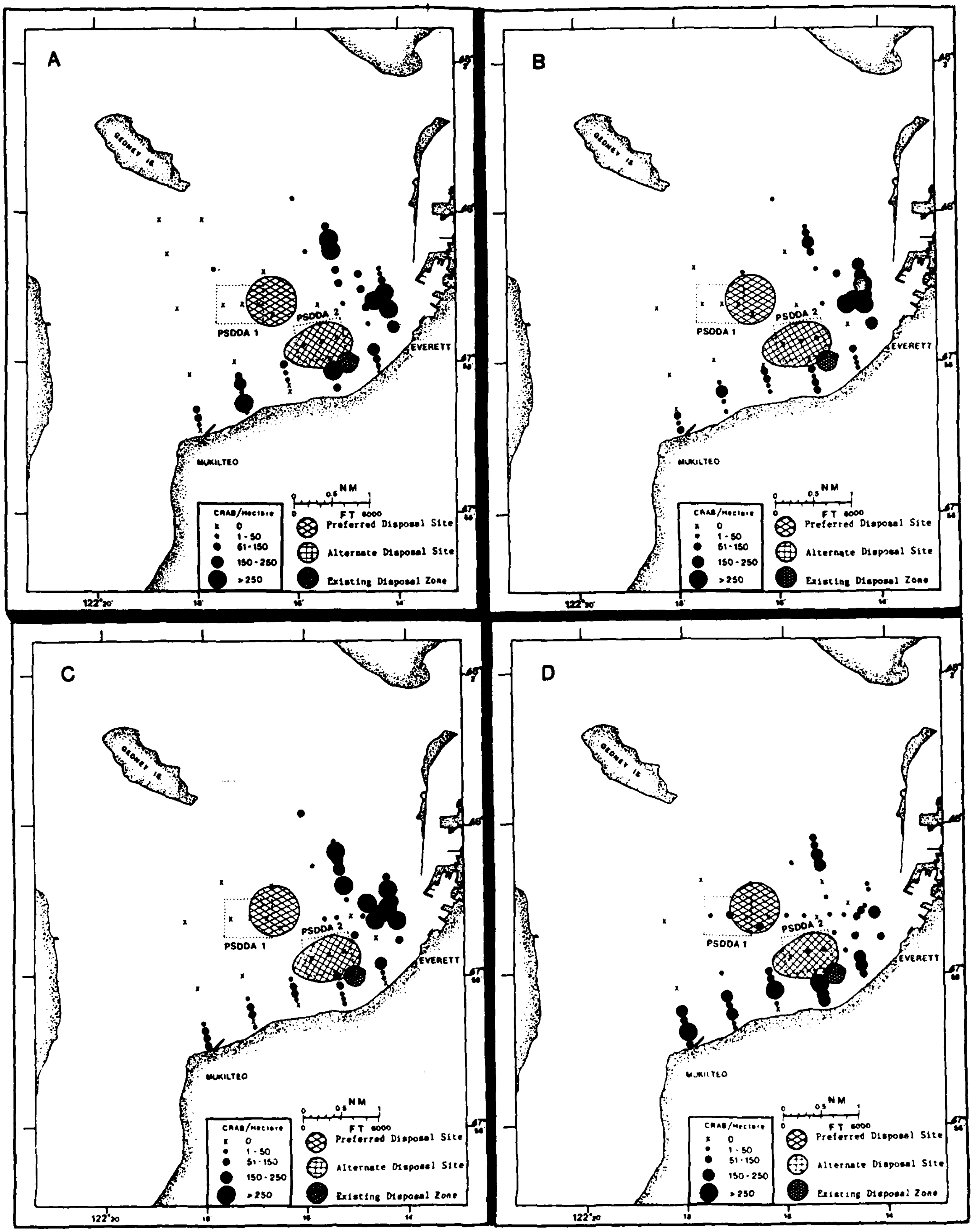


Figure 3.21 Port Gardner female crab density for: A) February, B) April, C) June, and D) September 1986; beam trawl. (Source: adapted from Dinnel et al., 1987b)

the total catch. The general distribution of crabs remained essentially unchanged from February to April, although, the average density decreased from 126 crabs/ha to 85 crabs/ha. These densities are similar to data from deep water trawls in north Puget Sound during the winter-spring period. Port Gardner crabs are not distributed randomly, but aggregated in many areas at densities two to four times higher than the average. Between February and April, the percentage of females with eggs decreased from 78 percent to less than 10 percent. Relative to the PSDDA sites, no crabs were collected in the preferred site (beam trawl transects), while no males were captured at the alternate site, but females were captured there in two of three transects, (calculated densities of 38 and 19 females per hectare). The selected site was at least 1.0 nmi from stations where high numbers of female crabs were caught. However, the alternate site was much closer to the high-density female crab stations (less than 0.25 to .50 nmi from the ZSF boundary) (figure 3.21b). The Saratoga Passage alternate site was not sampled in April.

In June, the average density of crabs was intermediate to the February and April densities (114/ha). Both spatial and depth distributions in June were similar to February/April patterns, except that males were found slightly deeper. Generally, both male and female crabs were caught along the nearshore slope from Mukilteo to the Snohomish River delta (figures 3.20c and 3.21c) and continued to be rare in deeper areas (greater than 100 meter depth) of outer Port Gardner. The distribution of male and female crabs along a bathymetric gradient is depicted in figure 3.22. Depthwise, the highest densities of female crab were from 20 to 110 meters, with peak densities at 80 meters. The depth distribution of males was uniform between 10 and 100 meters. Females comprised 91 percent of the catch and less than 1 percent of the females were gravid (with eggs). No crabs were caught at the PSDDA preferred or alternate sites. The selected site was substantially removed (about 0.75 nmi) from stations where highest numbers of female crabs were caught (figure 3.21c). In Saratoga Passage, more crab were caught during June than during February, although the crabs were confined to the shallow stations adjacent to and outside the ZSF containing the alternate site.

Dungeness crab distribution and densities remained essentially unchanged in September except that a few more males were caught in deep water (figure 3.20d). Female crab densities were again highest in the 20 to 100 meter range, with highest average densities again occurring at 80 meters (figure 3.21d). No male crabs were present in either the preferred or alternate PSDDA sites (figure 3.20d). However, female crabs were found in both sites (figure 3.21d). Abundance at the selected sites was 57 and 19 crabs per hectare (2 transects), while abundance at the alternate site was 19 crabs per hectare (2 transects). The general pattern of disposal site proximity to crab resources remained the same as found previously, with the selected site furthest removed from the areas of highest female crab abundance. For purposes of site comparison, the average estimated crabs/hectare for all Dungeness crab in Port Gardner during the four sampling seasons is presented in figure 3.23.

In December 1986/January 1987, crabs were sampled by beam trawl and their in situ abundance was investigated at the adjacent Navy "RADCAD" site using a

CRAB – PORT GARDNER

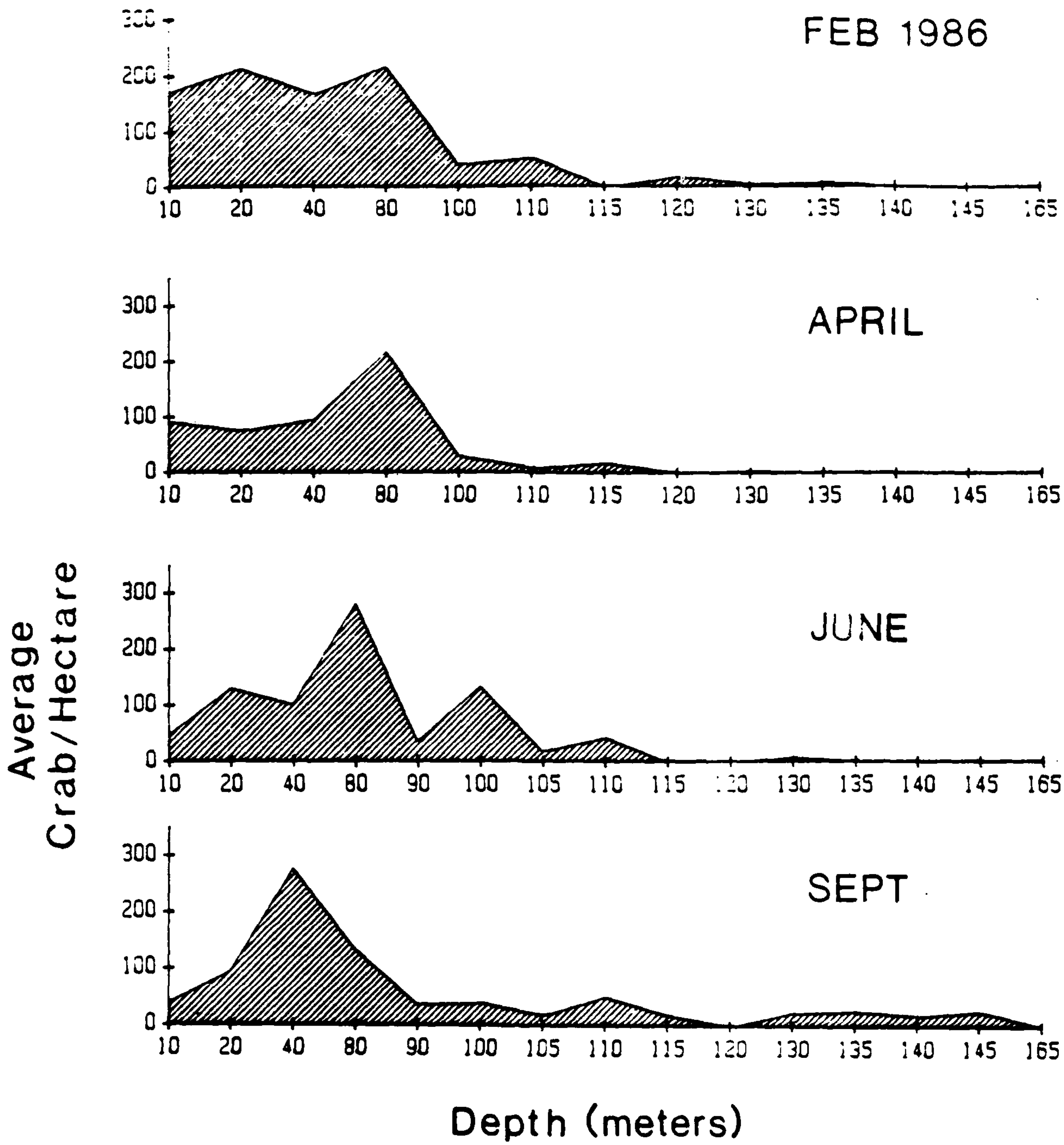


Figure 3.22: Distribution by depth of all Dungeness crabs caught by beam trawl in Port Gardner during seasonal sampling in 1986.
(Source : Dinnel et al, 1986a)

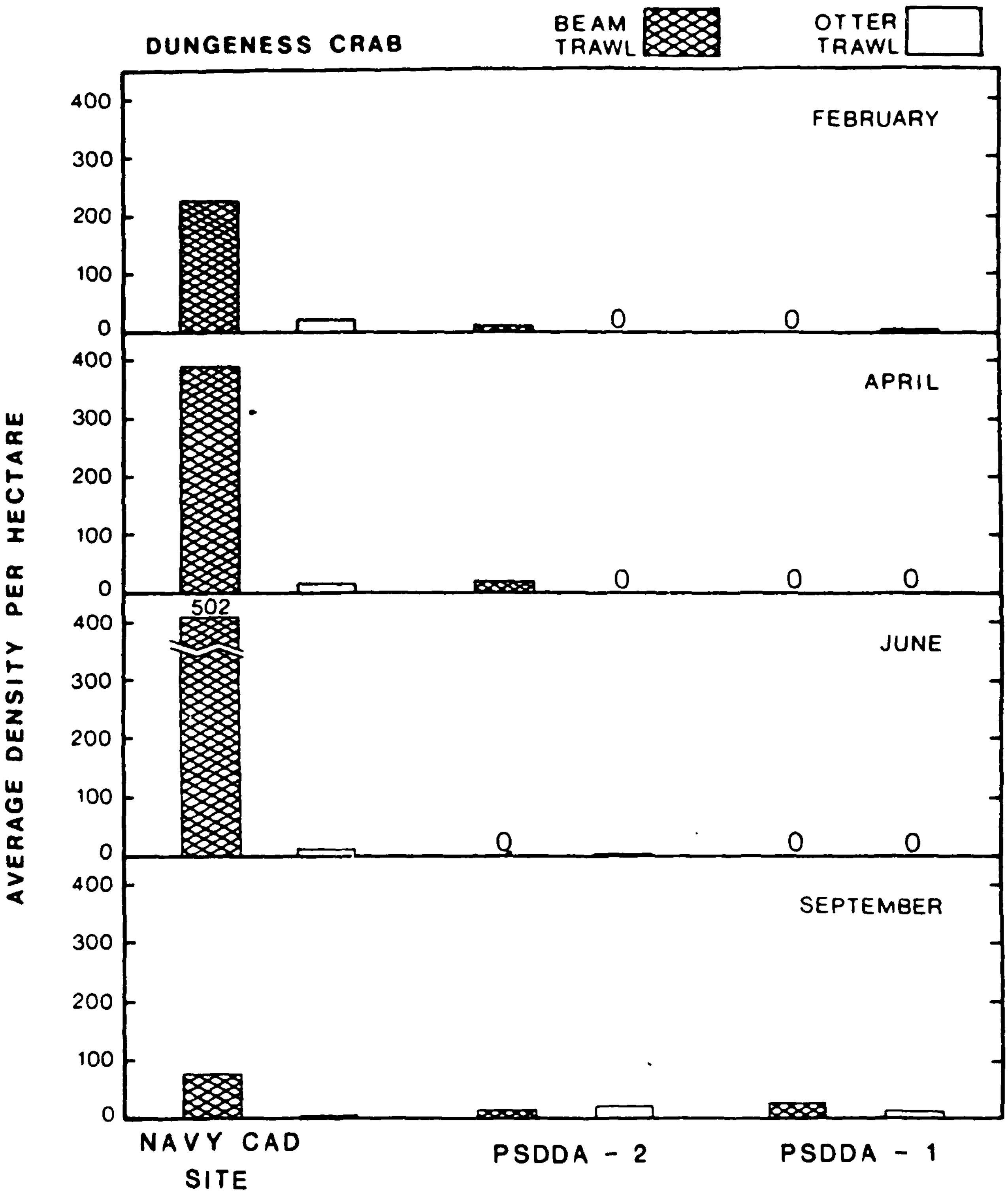


Figure 3.23 Trawl gear efficiency for crab in Port Gardner. (Source: adapted from Dinnel et al., 1986a)

deep submersible, the Canadian "Pisces IV" (Dinnel, et al., 1987). Results of beam trawl sampling indicated average densities of 71 crabs/ha in Port Gardner, but no crabs were found at the selected PSDDA site. The only significant catch occurred at the 40-meter depth station, south and some distance from the selected site. Pisces IV observations revealed that only occasional crab were present below 80-meter depths, including the RADCAD site. No gravid female crabs were observed.

Relative to shrimp resources, February sampling indicated highest densities at intermediate depths, with few found in shallow water (figure 3.24a). Species encountered were: pink shrimp (Pandalus jordani or P. borealis), side-stripe (Pandalopsis dispar), coon-striped (Pandalopsis danae), and spot prawns (Pandalus platyceros). The highest densities of shrimp occurred between 40 and 100 meter depths (figure 3.25). In the selected PSDDA site, no shrimp were caught with the beam trawl, but 135 shrimp per hectare were caught with the otter trawl (average based on three transects). In the alternate PSDDA site, 82 shrimp per hectare were caught with beam trawl and 355 per hectare were caught with the otter trawl (figure 3.26). The proximity of the disposal sites to densest concentrations of shrimp is similar to the situation observed for disposal site proximity to crab concentrations, with the selected PSDDA site generally further removed from the highest concentration areas (figure 3.24a).

April sampling indicated that shrimp were in much lower densities and were generally concentrated at the deeper stations (below 100 meters) (figures 3.24b and 3.25). In the preferred site, average densities of 63 shrimp/ha (beam trawl) and 24/ha (otter trawl) were calculated. In the alternate site, average densities were 13/ha (beam trawl) and 38/ha (otter trawl) (figure 3.26).

As in April, relatively few numbers of shrimp were present in June. Only the area off Mukilteo had high densities, with spot prawns abundant in 40 to 80 meters (figures 3.24c and 3.25). Overall, shrimp were most abundant at the 40 meter depth, a change from February and April when they were most abundant between 80 and 100 meters respectively (figure 3.25). In the preferred site, average densities of 6/ha (beam trawl) and 80/ha (otter trawl) were calculated. In the alternate site, average densities were 0/ha (beam) and 117/hectare (otter) (figure 3.26).

In September, the average density of shrimp calculated from all beam trawl stations increased to 269/ha, up substantially from past densities of 123, 19, and 30 shrimp/ha in February, April, and June, respectively (figure 3.24d). Average shrimp densities were greatest at the 40 to 80 meter depth range (figure 3.25). Several species of shrimp were present; no species was dominant. In the selected site, average densities of 32/ha (beam trawl) and 101/ha (otter trawl) were calculated. In the alternate site, average densities were 6/ha (beam trawl) and 86/ha (otter trawl). Comparative beam trawl and otter trawl catches of shrimp for September at the preferred and alternate sites and at the original Navy CAD disposal site are depicted in figure 3.26. Estimated shrimp abundances at beam trawl stations are presented

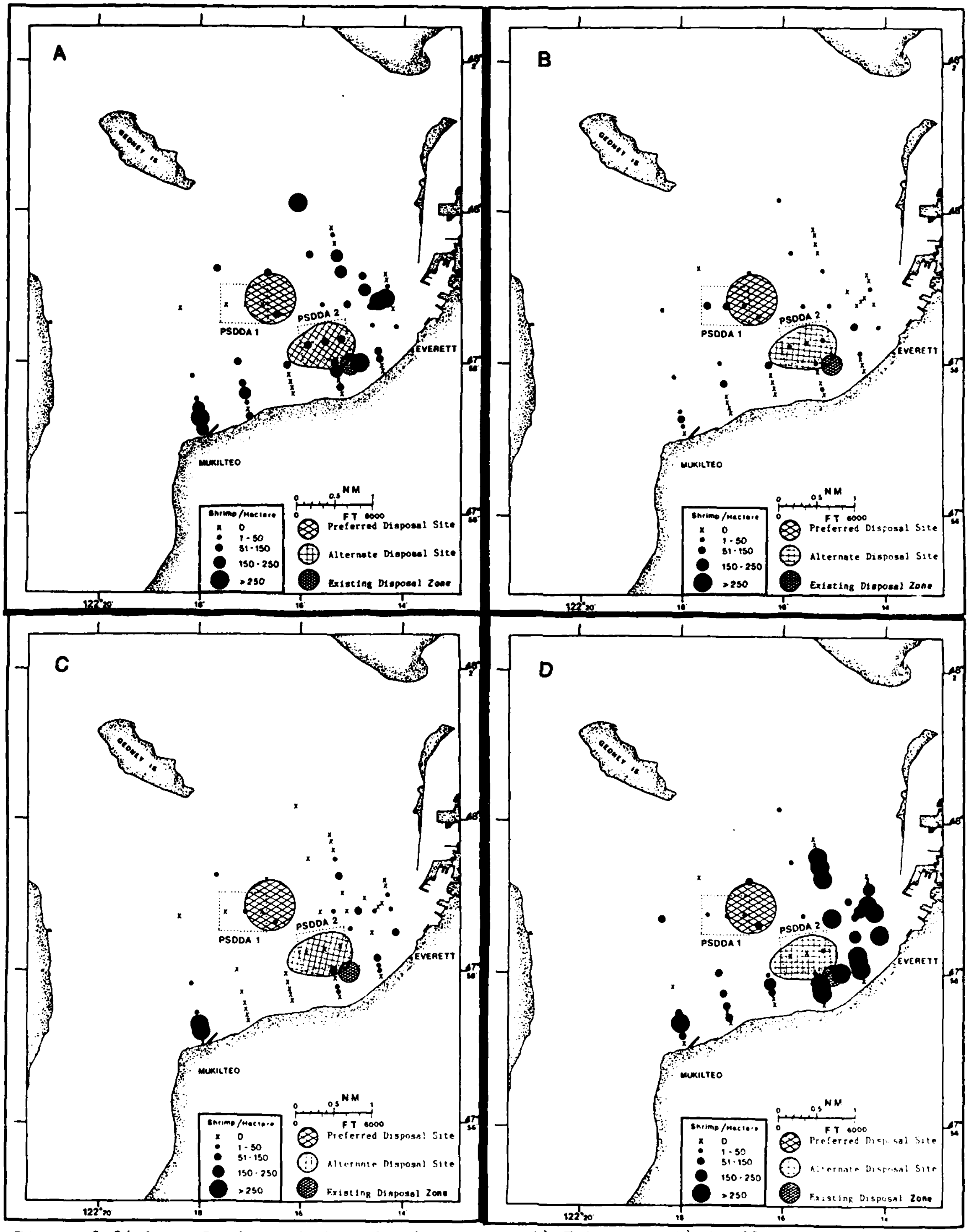


Figure 3.24 Port Gardner shrimp abundance for: A) February, B) April, C) June, and D) September 1986; beam trawl. (Source: adapted from Dinnel et al., 1986a)

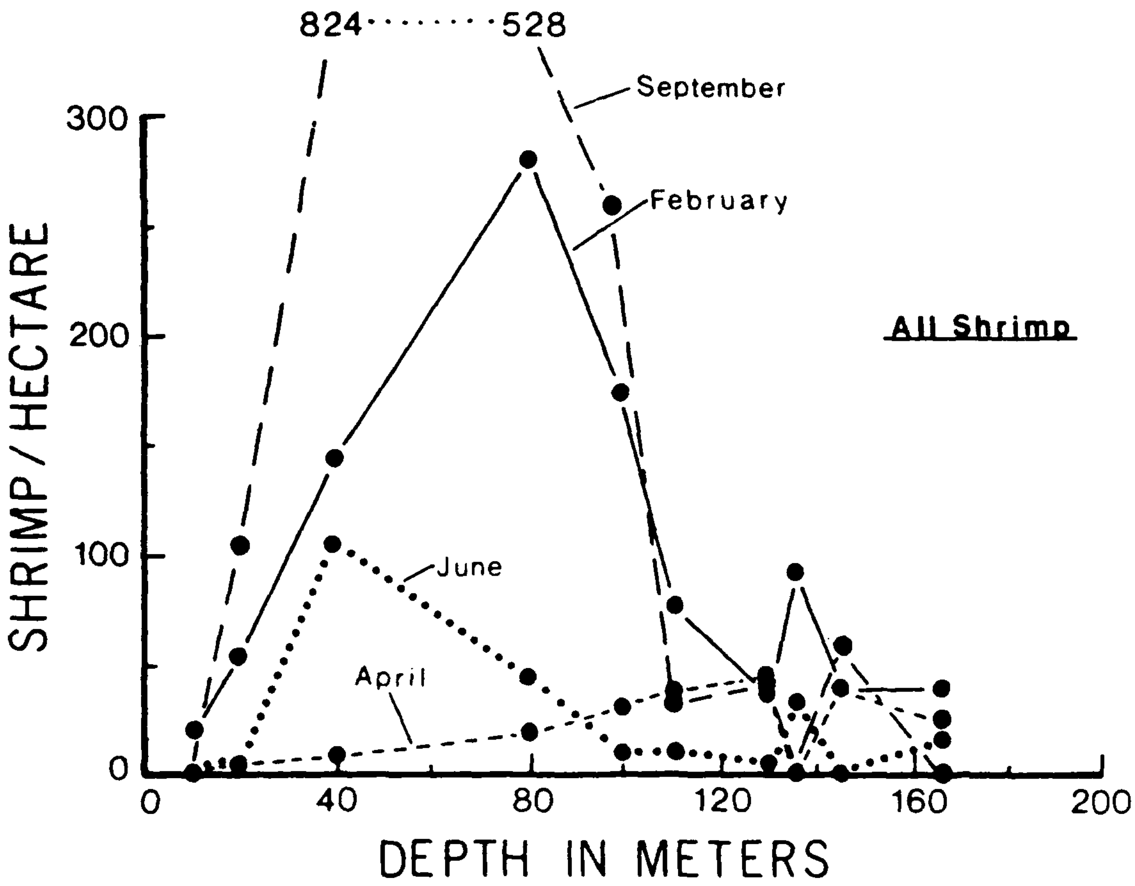


Figure 3.25 Average commercial shrimp densities by depth and by season in Port Gardner. (After Dinnel et al. 1987b)

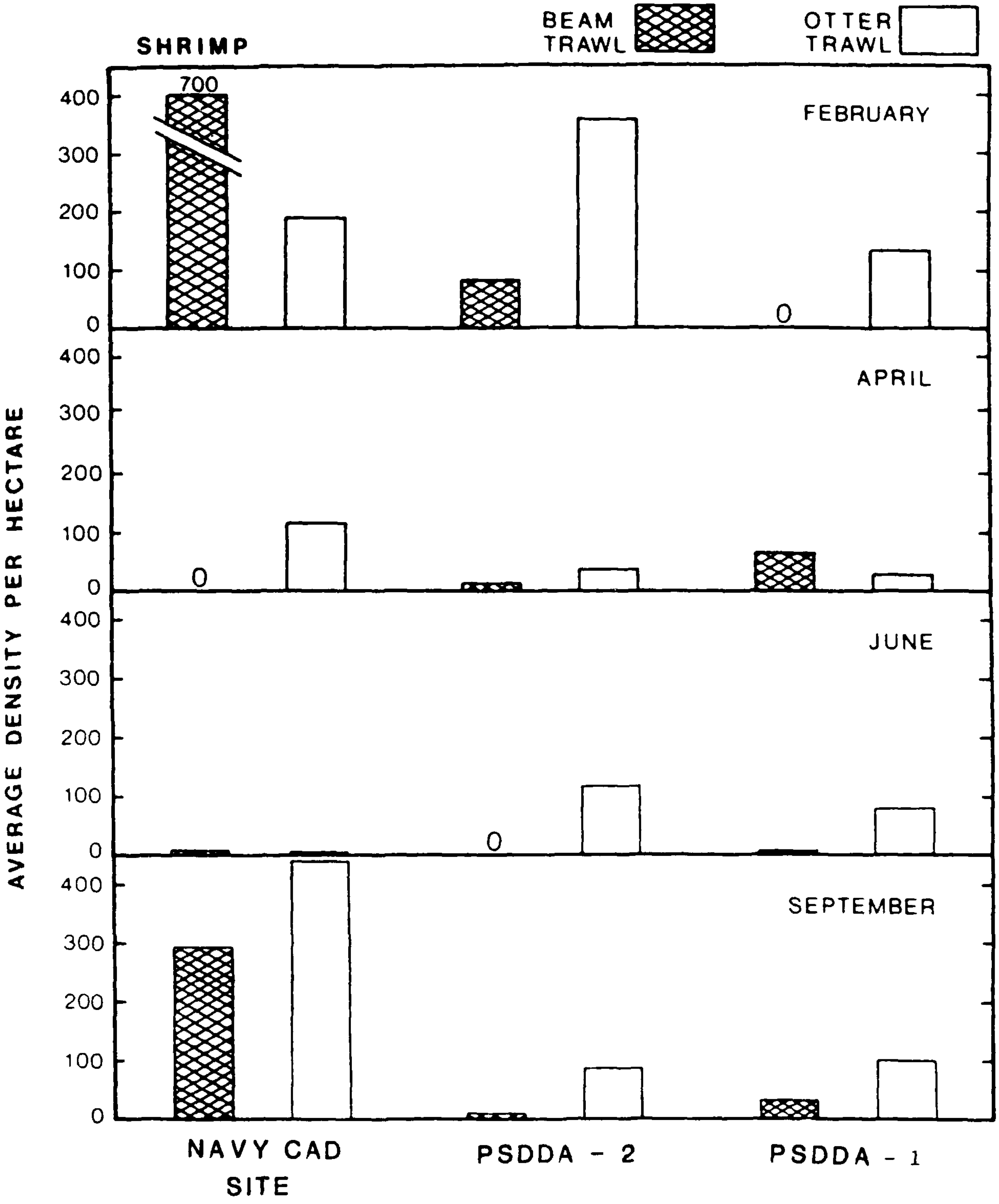


Figure 3.26 Trawl gear efficiency for shrimp in Port Gardner. (Source: adapted from Dinnel et al., 1986a)

in figure 3.24d. Average shrimp densities by depth and by season are shown in figure 3.25. Generalized species specific depth distributions are shown in figure 3.6. These data illustrate the very high numbers caught in September and the preferred depth range from 40 to 100 meters. The selected site boundary is located at least 1.0 nmi from areas of highest shrimp concentrations. The alternate site boundary by contrast is located very close to such areas, in one case within 0.25 nmi of a station with 250 shrimp/ha.

In December 1986/January 1987 average shrimp density (from beam trawl data) was 161 shrimp/ha. Average density at the selected site was 125/ha. This is a higher density than found during all other sampling seasons. However, the density was still not high enough for the selected site to be considered as an important shrimp habitat in Port Gardner or a potentially important commercial shrimping ground in the area. These results are consistent with previous results obtained during the other sampling periods.

Based on this information, it is concluded that only low abundances of shrimp are expected in the selected and alternate sites in any season, but that the alternate site is located in very close proximity to areas where moderate to high numbers can be expected, especially in the fall and winter months.

Shrimp catch data from Saratoga Passage indicated relatively low abundances there. Average beam trawl catches were 47 and 69 shrimp/ha for February and June, respectively. Average otter trawl catches were 126/ha. For comparative purposes, the Port Gardner sites averaged 24/ha. Sidestripe shrimp and pink shrimp were the most abundant species. Average total weight was 0.56 kg/ha compared to 0.1 kg/ha at the Port Gardner sites (averaged). For comparison, estimated average catches in commercial shrimping areas in Puget Sound and Hood Canal range from 0.8 kg/ha (Seabeck) to 15.1 kg/ha (Carr Inlet) (table 3.2).

(2) Plankton. Phytoplankton and zooplankton communities are generally ubiquitous throughout Puget Sound but exhibit tremendous spatial and temporal variations in species composition and abundances. The reader is referred to section 3.01b(2) for a general discussion of bloom periods and taxonomic/species succession.

(3) Anadromous and Marine Fishes. The Snohomish River system supports important runs of salmon and trout. The East Waterway and the Port Gardner shoreline are part of a major migratory route for these fish, primarily juveniles. Four species of salmon are present. These are chinook, coho, pink and chum salmon. Steelhead trout and Dolly Varden are also present. Timing of the salmon and trout freshwater life history phases in Snohomish Basin are provided as figure 3.27. For detailed discussion on run timing, hatchery and wild production, and migration pattern the reader is referred to Chapter III, Section A, of the U.S. Navy DEIS (1984). According to Tulalip Tribe fishery personnel (Williams, 1986), adult salmon returning to spawn use Port Gardner as a milling area prior to their upstream spawning runs.

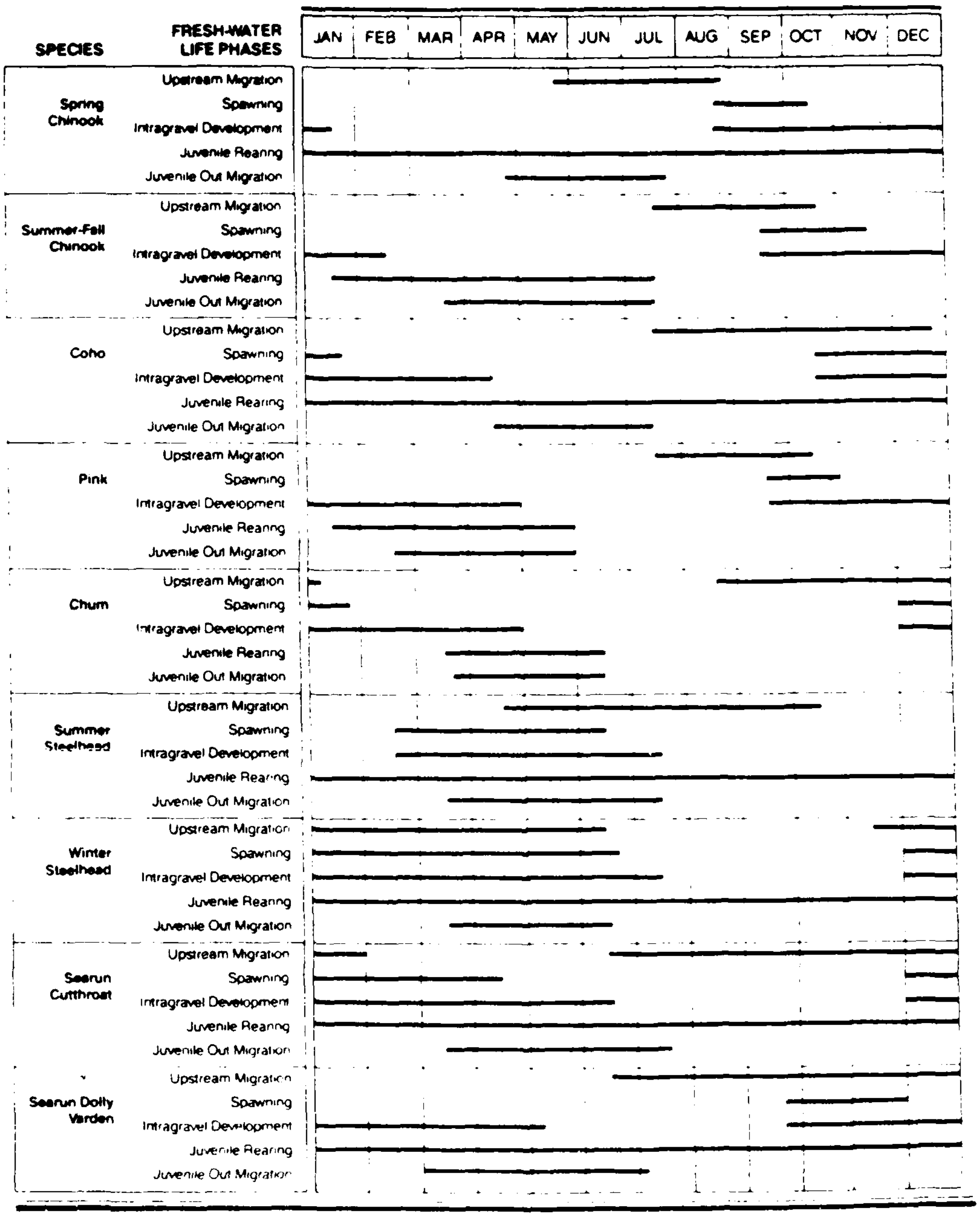


Figure 3.27 Timing of salmon and searun trout fresh-water life phases in Snohomish Basin.
(Source: U.S. Navy Draft EIS, 1984)

(a) Adult Salmonids. There are two races of chinook salmon, the spring-run and the summer/fall run varieties. The spring run is present in the Port Gardner vicinity generally between June and August, whereas fall run fish pass through Port Gardner generally between July and September. Spring chinook natural salmon runs in the Snohomish River are estimated to range between 150 to 500 fish between 1966 and 1971, averaging 450 fish per year. Summer-fall chinook natural salmon runs between 1966 and 1971 were estimated to range between 6,300 and 12,600 fish, averaging 9,200 fish per year. Natural runs are augmented by hatchery produced fish. The highest recorded run of chinook back to the hatchery located near Goldbar on the Skykomish River was 2,221 between 1966 and 1971 (Williams et al., 1975). In recent years combined spring and summer-fall chinook natural and artificial runs have exceeded 11,000 fish, with an estimated commercial and sport fish catch of up to 44,000 salmon (Williams et al., 1975).

Coho salmon enter Port Gardner generally between August and November. Coho escapements to the Snohomish River system are estimated to range from 32,100 to 74,500 between 1966 and 1971, averaging about 52,500 fish annually. Hatchery produced fish (Goldbar Facility) accounted for a peak escapement of 17,840 coho between 1966-1971. Catch to escapement calculations for coho production from the Snohomish Basin (natural plus artificial stocks) indicate this river contributes in excess of 210,000 fish to Puget Sound and ocean commercial and sport fisheries during an average year (Williams et al., 1975).

Pink salmon runs enter Port Gardner generally between August and September. Pink runs are estimated to range between 70,000 and 185,000 fish, averaging 118,000 fish per year in the Snohomish system. Catch to escapement ratios indicate that a spawning escapement of 150,000 fish reflects a catch of up to 300,000 pinks for the commercial and sports fisheries (Williams et al., 1975).

The chum salmon migration into Port Gardner is generally between September and December. Chum spawning escapements to the Snohomish system are estimated to have ranged from 3,000 to 28,000 between 1966 and 1971, averaging 12,500 fish annually. Catch to escapement ratios suggest that a spawning escapement of 30,000 chum to the Snohomish basin would reflect a catch of about 30,000 fish by the commercial fishery (Williams et al., 1975).

(b) Juvenile Salmonids. Significant numbers of juvenile chum, pink, chinook, and coho salmon are known to utilize the local marine waters of Port Susan, Everatt Harbor and Possession Sound from the end of March to the end of July. This was recently confirmed in a study (Snohomish River Juvenile Salmon Outmigration Study) conducted by Beauchamp, et al. (1986), and the Tulalip Tribes for the U.S. Navy. Results from this study are summarized below.

Juvenile pink salmon were found in large numbers throughout the marine littoral zone between the end of March and May 9. Chum and coho salmon exhibited sharpely defined peaks arriving in marine waters of Port Gardner between May 5-9. Chum were found in local sublittoral marine habitats over a 2-week period, whereas coho moved directly into the neritic zone and were

rarely encountered in shallow sublittoral waters after May 30. Chinook exhibited the longest presence in Port Gardner marine waters, with yearling smolts entering in a large pulse during the second week in April with continued low numbers moving in over a 7-week period. Subyearling chinook were found in marine waters beginning April 28 and were present in stable numbers through July 25. The protracted presence of subyearling chinook, coupled with the larger average size indicated utilization of marine waters for growth during the early marine stages

(c) Inshore Marine Fish Resources. Several species of marine fish inhabit East Waterway and Port Gardner. Dominant pelagic species are Pacific herring (*Clupea harrangus pallasii*), and northern anchovies (*Engraulis mordax*). Dominant inshore bottom fish species include English sole (*Parophrys vetulus*), starry flounder (*Platichthys stellatus*), Pacific staghorn sculpin (*Leptocottus armatus*), saddleback gunnel (*Pholis ornata*), Pacific tomcod (*Microgadus proximus*). Bay pipefish (*Syngonathus griseolineatus*), shiner perch (*Cymatogaster aggregata*).

(d) Bottomfish Resources in the Disposal Sites. Bottomfish distribution and abundance in Port Gardner were studied by the University of Washington during four seasons in 1986 (Dinnel, et al., 1986a). February sampling indicated that bottomfish were moderately abundant at both sites, with average densities of 403/ha at the selected site and 401/ha at the alternate site. Average biomass per hectare was similar at the two sites. For comparison purposes, the "original Navy CAD" site, located in shallower water, had 1,514 bottomfish/ha and about twice the average biomass of the PSDDA sites. Site catches were dominated by three species: Slender Sole, Ratfish, and Pacific hake. The latter species is commercially important.

In April, the average number of bottomfish caught per hectare was significantly lower than observed in February. At the selected site, only 68 individuals/ha were caught and, at the alternate site, 103 fish/ha were caught in April. Average bottomfish biomass per hectare was markedly lower at both sites in April compared to February. For comparison, the "Navy CAD" site had 434 fish/ha and nearly triple the biomass of the ZSF sites. The most abundant fishes were English sole, Dover sole, slender sole, Pacific hake and ratfish.

In July, the selected site again showed the least bottomfish abundance and biomass. Average catch for all species was 60 and 156 fish/hectare at the preferred and alternate sites, respectively. Average biomass was 11.29 kilograms/hectare at the selected site ZSF, 23.05 at the alternate site (compared to 50.77 at the Navy CAD site). Dominant species were English sole, Dover sole, and Ratfish.

In September, catches of bottomfish fish were relatively low at both sites, compared to catches at shallower stations. Biomass was lowest at the selected PSDDA site.

In general, both PSDDA sites had markedly lower bottomfish densities and biomass compared to shallower stations throughout the year. In comparing the

sites, highest species abundance varied with season, but lowest biomass was always observed at the selected site.

In the alternate site at Saratoga Passage, only June data was available (BRAT), but average catch per trawl was ten, consisting of six species. Slender sole was most abundant.

(e) Foodweb Relationships: BRAT Assessment of Bottomfish Feeding Habitat Values in Disposal Sites. The reader is referred to Section 3.02b(3)(e) and the Disposal Site Selection Technical Appendix (DSS TA) for an overview of the rationale and description of the BRAT analysis. Bottomfish feeding strategy groups identified through the BRAT field studies conducted by the Waterways Experiment Station during June/July 1986 are summarized in table 3.3 (see Clarke 1986; DSS TA). Four benthic feeding strategy groups were identified that appeared to be exploiting infaunal benthos heavily, and were primarily represented by Dover sole and English sole. Figure 3.28 illustrates the distribution and amount (g/m2-wet biomass) of potential benthic food particles available to each of the four feeding strategy groups at each site in Port Gardner, while figure 3.29 shows the relatively impoverished benthic resource values demonstrated at the Saratoga Passage alternate site.

Comparative analysis of mean resource values at all three sites indicates that feeding habitat potentials were relatively similar for all four bottomfish feeding groups at the selected site ranging from a low average of 12.3 g/m2 (Group IIA) to a high average of 19.6 g/m2 (Group IIB). By contrast, the feeding habitat values were higher at the Port Gardner alternative site and ranged from an average of 15.2 g/m2 (Group IIA) to a high average of 35.1 g/m2 (Group IIIA). This suggests that there is a larger reservoir of deeper dwelling and generally larger sized benthic prey available to the Group IIIA fish at the alternate site location than at the preferred site (table 3.4). Comparatively, average benthic fish food resource values were much lower at Saratoga Passage than at either of the two sites at Port Gardner, ranging from an low habitat value of 2.6 g/m2 (Group IIA) to a high of 7.2 g/m2 (Group IIIA). There was three times as much benthic habitat value potentially available for Group IIIA predators than for Group II, at Saratoga Passage but benthic resource values were lower than those observed at any of the study areas in central Puget Sound. All four feeding groups observed were primarily exploiting polychaete and bivalve mollusc prey in proportion to that observed at benthic core stations previously discussed (section 3.04b(1)(b)).

(4) Marine Mammals. All of the marine mammals found in Port Gardner and Saratoga Passage are migratory and have wide distribution patterns. Therefore, they are discussed in the regional setting section. The reader is referred to the regional marine mammals section 3.01b(4) for this discussion.

(5) Water Birds. As at Commencement and Elliott Bays, the most numerous waterbirds at Port Gardner are diverse such as loons, grebes, cormorants, and bay ducks. Gulls are also numerous. Relatively few species of shorebirds and waders are found in the project vicinity.

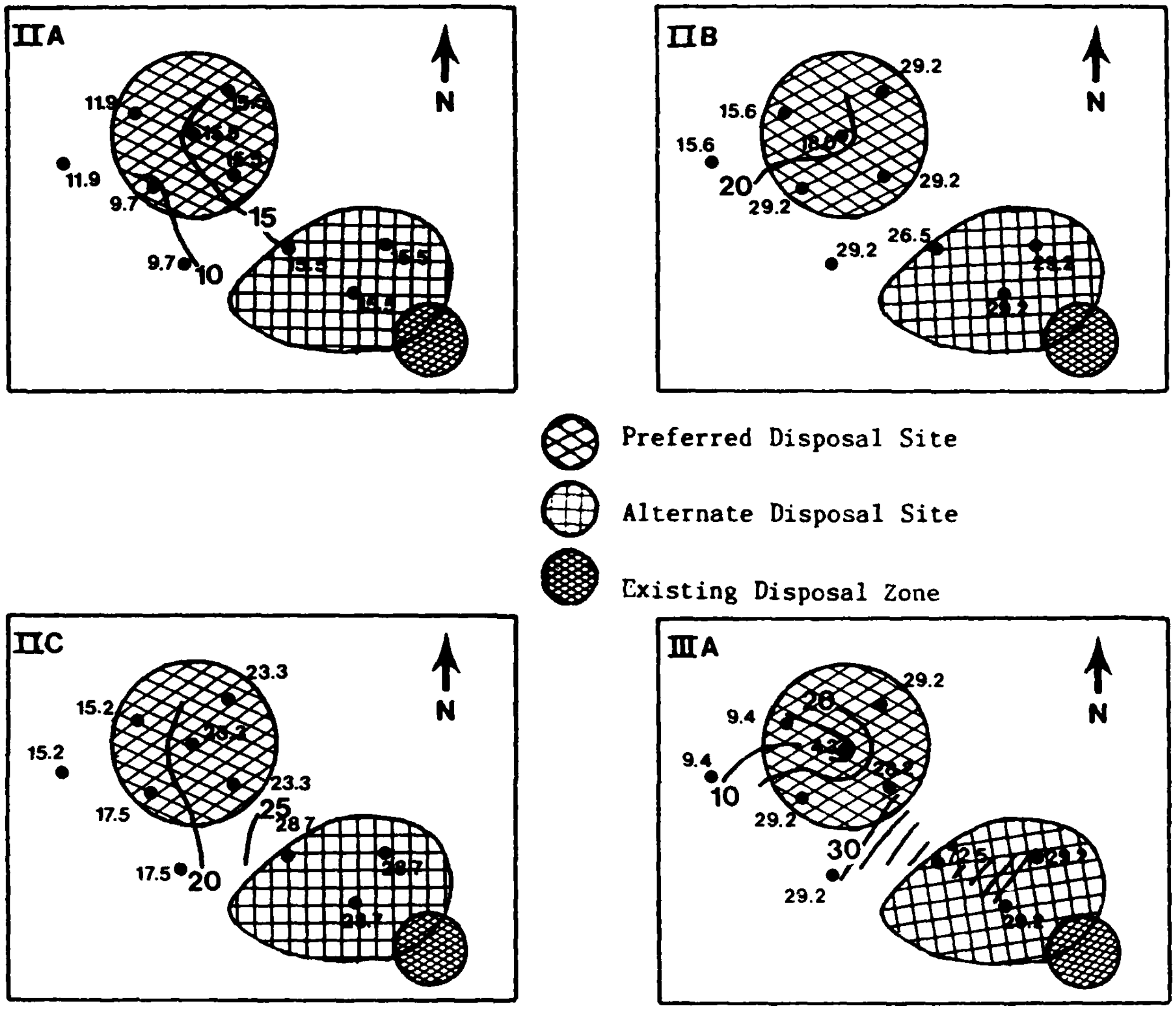


Figure 3.28 Benthic biomass potentially available in Port Gardner to four groups of fish. Units of biomass are in grams per square meter. (Source: adapted from Clarke, 1986)

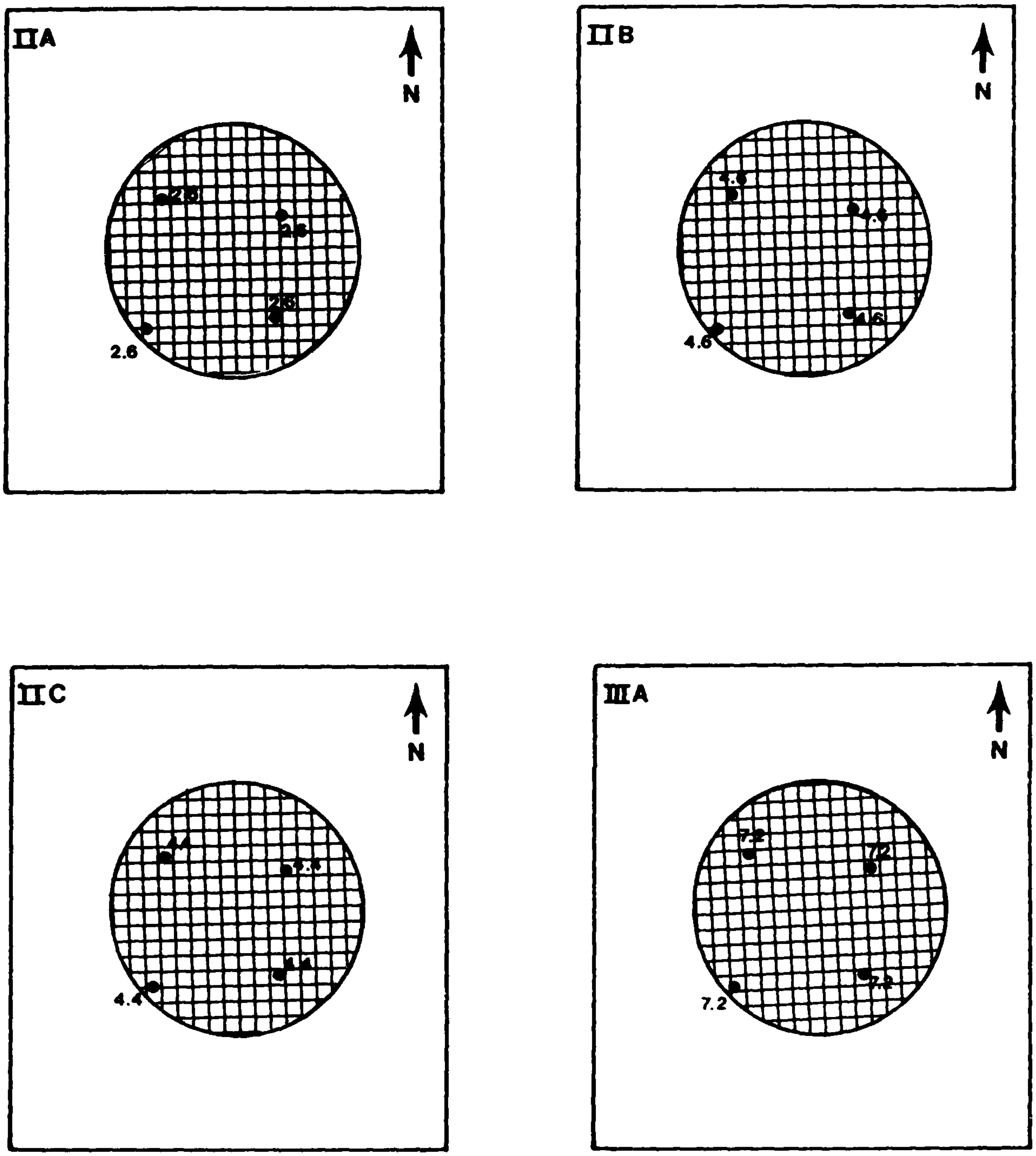


Figure 3.29 Benthic biomass potentially available in Saratoga Passage to four groups of fish. Units of biomass are in grams per square meter.
(Source: adapted from Clarke, 1986)

Because of the presence of consistently large numbers of wigeons and mallards, the Snohomish River delta has been classified as an "Area of Biological Significance" (AMBS), for fall and winter populations of American wigeon and mallard by the Washington State Department of Ecology (Gardner, 1981).

Jetty Island is an AMBS because it provides nesting habitat for the only breeding colony of Artic terns in the contiguous western United States. Containing 10 pairs of nesting terns in 1978 (Manuwal, et al., 1979), this small colony on Jetty Island supported only one breeding pair in 1984 (Hunn, personal communication, 1984). Jetty Island also is the location of a colony of approximately 150 pairs of glaucous-winged gulls.

Several species of waterfowl also nest on the island. In 1984, three mallard, three gadwall, and three Canada goose nests were found with brooding birds. Several more mallards and gadwall nests most likely occur as suggested by birds flushed during the censuses. An additional five pairs of geese successfully nested on the island as determined from counting adults with goslings at the water's edge. Low numbers of mallards, and Canada geese have been known to nest since first observed in 1977 (Peters, et al., 1978). The nesting of gadwall and increasing use by Canada geese, however, has not been documented.

Bonaparte's gulls are occasionally abundant. Flocks of these small gulls first appear in late April. Small numbers of Bonaparte's gulls are observed with common terns in late summer and autumn.

West of Jetty Island are extensive mud and sand flats formed by sediments from the Snohomish River. Large eelgrass beds also occur. During low tides, this shallow water area is heavily used by feeding great blue herons, glaucous-winged gulls, Bonaparte's gulls, brant, spotted sandpipers, and other waterbirds. Shorebirds feed on invertebrates along tidal flats and drift lines. During their spring migration, they may be especially abundant along exposed tidelands in Puget Sound and its existing bays. Spring and summer censuses on Jetty Island indicate little use by either resident or migrating shorebirds.

The protected waters of the Snohomish River channel and the East Waterway are used by several species of waterbirds. In winter, between 150 and 250 western grebes, 25 to 30 cormorants, and flocks of 25 to 50 scaup raft and feed in the river channel. Barrow's goldeneyes, red-breasted mergansers, pied-billed grebes, horned grebes, marbled murrelets, and ruddy ducks overwinter in the protected bays and channels adjacent to Norton Terminal. In summer, glaucous-winged gulls, several pairs of mallards and up to 10 great blue herons are the prime users of the East Waterway.

The alternate site in Saratoga Passage is in an area of low waterbird usage. Protected bays along Saratoga Passage (such as Holmes Harbor and Penn Cove) attract relatively large numbers of migrants and winter residents of all families of waterbirds described in the "General" paragraph. The alternate site receives use by birds only as a resting or feeding point in calm weather, or when fish may be particularly abundant, such as during the spawning season for hake. The selected disposal site is near a hake spawning area. Otherwise, the proposed disposal area is not normally an area of bird concentrations.

(6) Endangered and Threatened Species. Bald eagles nest along Pigeon Creek 2 miles south of the Port of Everett. They also nest at seven other locations (12 nests in all) within 10 miles of the selected disposal site. Of these other nests, three are about 5 miles from the disposal site, and one is about 2 miles from the site. During the winter, bald eagles tend to shift inland to rivers to feed on spawned out salmon. As at Commencement and Elliott Bays, they are present year round in the Port Gardner vicinity.

Peregrine falcons are rare in the vicinity, primarily due to the lack of a large prey base, and because of industrial activity in the vicinity. Habitat does exist for peregrines in the Snohomish River estuary, and the Everett sewage ponds attract large numbers of gulls and waterfowl. The potential exists for peregrines to winter in the area.

Gray whales have been sighted in Port Susan at Kayak Point in 1984. As at Commencement and Elliott Bays, the gray whales seen near Port Gardner are stragglers and do not stay in any one location for long.

There are no recent sightings of humpback whales near Port Gardner. Their rarity makes the possibility of regular sightings remote.

In the vicinity of the Saratoga Passage alternate site there are several bald eagle nests on Whidbey Island, and one nest on Gedney Island. Bald eagles are present throughout the year and can be expected to feed (at least occasionally) near the proposed disposal area, perhaps occasionally on hake. Peregrine falcons migrate through Puget Sound. They do not nest in the vicinity of the alternate site at Saratoga Passage. The nearest wintering area is at Skagit River delta lowlands. Peregrines probably feed near the proposed site on rare occasions.

There are no records of either gray whales or humpback whales in the vicinity of the Saratoga Passage alternate site.

The BA's prepared for the PSDDA Phase I study area are contained in exhibit A. More detailed descriptions of the Port Gardner threatened and endangered species, and their habitat, are provided in the BA's.

c. Human Environment.

(1) Social Economic. The dredging areas that would use the Port Gardner unconfined, open-water disposal site include portions of Kipsap and Island Counties, most of Snohomish County, and the cities of Everett and Edmonds. Snohomish County is the third largest county in the State with a population of 373,000 in 1985. Population growth over the last decade has also been due to a variety of economic factors including expansion by Boeing and other high technology companies. Population forecasts by the Washington State Office of Financial Management show the population of Snohomish County increasing to 498,800 by the year 2000. Major port redevelopment is anticipated in the near future in the East Waterway and to the south along the Everett Harbor shoreline. Waterborne commerce through Everett Harbor has decreased from 4,367,000 short tons in 1975 to 3,758,000 short tons in 1985.

(2) Navigation Development. Most commercial port activity in the past has focused on the East Waterway where log-ships have made frequent port calls. Just outside the East Waterway, the Port of Everett operates a bulk cargo transfer and storage facility. Major redevelopment of the East Waterway and portions of the Everett waterfront to the south are anticipated as a direct consequence of the proposed U.S. Navy Carrier Battle Group Puget Sound Region Ship Homeporting project. The lower Snohomish River continues to experience shallow draft navigation in the form of pleasurecraft and log-rafting.

Figure 3.30 and table 3.5 illustrate historical wetland habitat losses from 1880 to the present in the Snohomish Estuary, and indicate that almost 75 percent of the wetlands have been lost.

Existing navigation channels, all federally maintained, are described below:

- East Waterway. This channel, approximately 0.6-mile long with width varying from 700 to 900 feet, is currently maintained to a depth of 30 feet below MLLW.

- Snohomish River. Beginning near the entrance to the East Waterway, this channel extends upstream about 6.3 miles. Authorized channel depths and widths vary as follows:

	Depth (feet below MLLW)	Width (feet)
Port Gardner to River Mile (R.M.) 0.6	15	150
R.M. 0.6 to R.M. 0.85	15	425
R.M. 0.85 to R.M. 1.2	20	700
R.M. 1.2 to R.M. 6.3	8	150

(3) Dredging and Disposal Activity.

(a) Historical Activity (1970-1985). Between 1970 and 1985 5,499,000 c.y. of material were dredged from the Port Gardner area (table 3.6). As with the other Phase I areas, only a small volume of this material (13 percent) was disposed at the DNR designated open-water site while most of the material (87 percent) was placed upland or nearshore.

In the period 1970-1985, most of the dredging (47 percent of the total activity) was undertaken by the Corps. The remainder of the volume of material dredged in Port Gardner and vicinity was roughly evenly split between Port of the Everett and others.

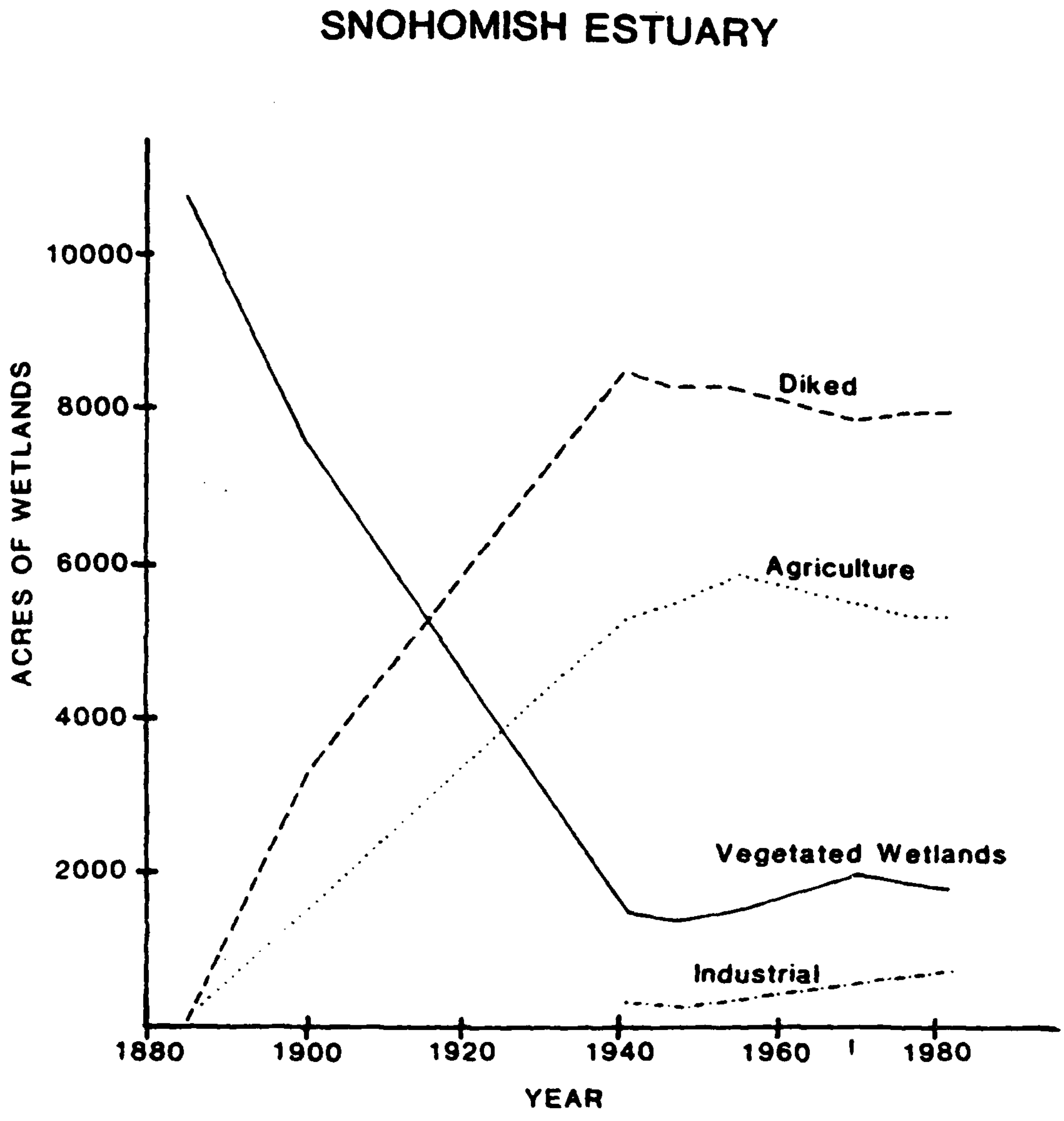


Figure 3.30 Loss of Vegetated Wetlands in the Snohomish Estuary (Source: Boule et al. 1983)

(b) Projected Activity (1985-2000). As stated earlier, dredging in Port Gardner and vicinity is expected to dramatically increase over the past (see table 3.7). This is especially true if the Navy Homeport project in Everett is developed. This project alone will account for 3.3 million c.y. (31 percent of projected total for Port Gardner) of the material to be dredged.

Excluding the Navy Homeport project, almost all of the rest of the sediment forecasted to be dredged in Port Gardner and vicinity (86 percent of total) will come from the Snohomish River. Most of the material removed from the Snohomish River will be from navigation channel maintenance dredging by the Corps. The Snohomish River, like the Duwamish River, receives large amounts of bedload during high water flow. This material needs to be dredged periodically (once every 1-3 years) to maintain authorized channel depths.

(4) Native American Treaty Fishing. The tribes that generally fish in the Port Gardner area are the Tulalip and the Stillaguamish Tribes. Fishing by the Stillaguamish Tribe has been at the invitation of the Tulalip Tribes. Harvest records indicate that the Tulalips are the primary commercial fishermen in the Port Gardner area.

Tribal commercial fisheries are generally active from July through January, concentrating on harvestable stocks of Snohomish and Stillaguamish Rivers coho, chum, chinook and pink salmon, and steelhead trout. The majority of tribal fishing pressure generally occurs at night. To protect depressed Stillaguamish stocks, most notably the Stillaguamish chinook, harvest of Stillaguamish runs have been drastically reduced in recent years. However, with increased production through tribal enhancement programs, and increased fishing effort, tribal fishing fleets have increased over 50 percent in the last 10 years.

Stationary and drift gillnets have been major fishing methods used in the area. Drift gillnets have been regularly used in the offshore areas, including the location of the selected disposal site.

(5) Non-Indian Commercial and Recreational Fishing. Port Gardner Bay supports a number of non-Indian commercial and recreational fisheries activities. The following summary is based on the latest WDF catch statistics for 1985-1986 (Dale Ward, personal communication, 1987). Sport catches of chinook and chum salmon for the areas, including Port Gardner, Camano, Deception Pass, and Skagit, were reported at 6,607 fish during 1985 (mostly from Skagit). Commercial salmon catches of chinook, chum, and coho totaled 103,842 fish for 1986 and 74,955 pink salmon in 1985 between Port Susan and Port Gardner. Bottomfish catches of true (Pacific) cod, English sole, and rockfish totaled 49,370 pounds between Port Gardner and Possession Point during 1986. A significant herring fishery exists between Port Gardner and Possession Point and 431,023 pounds were caught during 1986. Surf perch (shiners) catches totaled 9,952 pounds in 1986 between Port Gardner and Possession Point. Crab catches totaled over 55,000 pounds from Possession Point down to Port Gardner in 1986.

(6) Esthetic Setting. The esthetic setting is Port Gardner Bay and Possession Sound, including seabirds, marine mammals, and a wide variety of ship/boat traffic, Whidbey Island, and the Olympic Mountains. The principal views of this setting are from the Everett waterfront area, including the Norton Avenue Terminal, the shoreline south of the Everett city limits, the tall buildings of the central business district, and residential areas above the shoreline to the east.

SECTION 4. ENVIRONMENTAL EFFECTS OF ALTERNATIVES

4.01 Introduction. Section 4 presents an environmental effects assessment of the alternatives considered in detail by PSDDA. As presented in section 2 (see table 2.1), the possible alternatives include "No Action" for the entire Phase I area and various combinations of disposal sites and biological effects conditions for site management. In all, there are 21 combination alternatives possible (seven sites; two in Commencement Bay, two in Elliott Bay, and three in Port Gardner) and three biological effects site management conditions.

The final number of alternatives considered in this section is 14. The 14 alternatives, shown in table 4.1, permit an effective evaluation of the impacts of the PSDDA selected and nonselected alternatives on the physical, biological, and human resources of Puget Sound.

When assessing the potential effects of each alternative, an evaluation of impacts necessarily had to include the impacts associated with unconfined, open-water disposal, as well as the consequences of disposal of material not suitable for unconfined, open-water disposal. Dredged material not acceptable for unconfined, open-water disposal was assumed to be placed at a confined site, even though some marginal projects may in fact not be dredged if high cost confined disposal is the only option. While confined disposal methods include confined aquatic disposal (CAD), this technique has only limited public acceptance at this point. Consequently, though some CAD is likely to occur, in the near-term, a large proportion of the material requiring confinement will likely go to the other confined disposal options, principally upland and nearshore areas. In addition, an analysis of the impacts to both open water and land environments serves to highlight the fact that environmental tradeoffs exist regardless of where dredged material is disposed.

The smaller the quantity of dredged material placed at the unconfined, open-water disposal sites, the greater the quantity of material requiring upland/nearshore disposal (and vice versa). As such, the risk associated with chemicals of concern in dredged material will shift between aquatic and land sites. Site conditions that allow the least amount of chemicals in material to be placed at the unconfined open-water sites, would place most of the environmental (terrestrial species, freshwater species) and human health (exposure, drinking water) risks associated with chemicals of concern at the confined sites. Conversely, selection of an alternative which allows for the placement of dredged material with high levels of chemicals of concern at the unconfined open-water sites would place most of the environmental (benthic species, marine fish) and human (chemicals in seafood) risks at these sites. A general analysis of the environmental and human health tradeoffs between disposal of dredged material at unconfined, open-water sites and at confined land sites is presented in section 2.04.

Since conducting an impact assessment for a programmatic action involves making many predictions about future conditions, several key assumptions must be noted here. First, the assessment assumes that most dredged material found to

TABLE 4.1

FINAL EIS ALTERNATIVES
EVALUATED FOR THE PHASE I AREA

EIS Alternative	Description	Addressed in EIS Section
No Action	"No Designation of Public Multiuser Unconfined, Open-Water Sites" (Use of Puget Sound Interim Criteria)	4.02
Commencement Bay		
CB1-II	Commencement Bay Site 1 and Site Condition II (selected alternative)	4.03
CB2-II	Commencement Bay Site 2 and Site Condition II	4.04
CB1-I	Commencement Bay Site 1 and Site Condition I	4.05
CB1-III	Commencement Bay Site 1 and Site Condition III	4.06
Elliott Bay		
EB1-II	Elliott Bay Site 1 and Site Condition II (selected alternative)	4.08
EB2-II	Elliott Bay Site 2 and Site Condition II	4.09
EB1-I	Elliott Bay Site 1 and Site Condition I	4.10
EB1-III	Elliott Bay Site 1 and Site Condition III	4.11
Port Gardner		
PG1-II	Port Gardner Site 1 and Site Condition II (selected alternative)	4.13
PG2-II	Port Gardner Site 2 and Site Condition II	4.14
PG3-II	Port Gardner Site 3 and Site Condition II (Saratoga Passage)	4.15
PG1-I	Port Gardner Site 1 and Site Condition I	4.16
PG1-III	Port Gardner Site 1 and Site Condition III	4.17

be acceptable for unconfined, open-water disposal (under the EIS action alternatives) will be discharged at the PSDDA identified unconfined, open-water disposal sites. Though some material will likely be placed in nearshore or land sites as part of occasionally approved fill projects, the relatively inexpensive and available unconfined, open-water sites are likely to be preferred by most project proponents who simply want to dispose of dredged material.

A second key assumption made is that most material unsuitable for unconfined, open-water disposal is expected to be dredged, not left in place. Though the cost of confined disposal will likely render some projects economically infeasible, the number of projects that will opt to not dredge cannot be easily ascertained for this programmatic analysis. Consequently, the analysis assumes that comparable volumes of dredging will be conducted regardless of the site management condition considered.

A third assumption that is important to the EIS analysis is that adequate capacity will be available for confined disposal of dredged material that is not suitable for unconfined, open-water disposal. Now that the need for confined disposal sites has become readily apparent, it is anticipated that larger dredging projects will be identifying and establishing disposal sites with sufficient capacity to accommodate near-term forecasts. For longer term use, the PSWQA has clearly identified the need to establish multiuser confined disposal sites for dredged material. Ecology has recently initiated a comprehensive study to meet this need. To the extent that adequate capacity is not made available when required, it is recognized that some projects may be delayed or not dredged. However, the assessment in this EIS is premised on the availability of confined disposal sites as the need arises for, and is pursued by, individual projects and future agency programs.

The cost analysis of the alternatives evaluated in this EIS is considered to be a reasonable assessment of what would result from the implementation of those alternatives, based on the above and other assumptions (see EPTA, Part II, paragraph 10, for the detailed presentation of the cost analysis). It is accepted that with other assumptions regarding the mix and costs of confined disposal options that cost impacts of the alternative site conditions could be much greater than shown. However, even if this were the case, the same alternatives would have been selected as higher costs reinforce this selection.

This EIS primarily addresses the alternatives for, and environmental consequences of, the disposal of suitable dredged material at designated unconfined, open-water sites in Puget Sound. The environmental impacts associated with dredging operations are not presented in this impact assessment. The impacts at the dredging site would be similar for all alternatives, since most disposal projects that would be dredged under any one alternative would be dredged under all alternatives. The PSDDA EIS does not preclude or obviate the need for these project-specific assessments.

ENVIRONMENTAL EFFECTS OF NO ACTION ALTERNATIVE FOR THE PHASE I AREA

4.02 No Action: No Designation of Public Multiuse Unconfined, Open-Water Disposal Sites. The No Action alternative that is assessed here for the entire Phase I area is "No Designation of Public Multiuser Unconfined, Open-Water Disposal Sites." As discussed in section 2, in the absence of PSDDA, local jurisdictions would be expected to deny shoreline permits to DNR for public unconfined, open-water disposal sites. However, limited unconfined, open-water disposal would continue on a project by project basis where the dredged material meets PSIC and local shoreline jurisdictions are willing to grant conditional use permits. This would likely occur in cases where the disposal will either have a beneficial use or the appropriate environmental impact studies will have been undertaken. All of the elements of dredged material management addressed by PSDDA e.g., evaluation procedures, site location, environmental monitoring, etc. would also be expected to as conditions of a shoreline permit. About 2.25 million c.y. is estimated to be found acceptable for unconfined, open-water disposal or only 12 percent of the dredged material forecasted for the period 1985-2000 (see table 4.2d1/).

Proper siting of upland and nearshore confined disposal facilities would be the primary key to minimizing environmental impacts under this alternative. Once suitable site locations have been found, sites can be designed to acceptably contain chemicals of concern. "Acceptability" of a given design for contaminant control is heavily dependent on site specific characteristics. Since no specific upland and nearshore sites have been identified, the presentation that follows is of a general nature and suggests possible impacts of accepting the No Action alternative. Detailed environmental assessment of specific upland and nearshore sites would need to be conducted on a project-specific basis in order to fully evaluate the impacts of confined disposal.

a. Impacts and Their Significance to the Physical Environment.

(1) Water Quality.

(a) Marine Water. Little direct impact is expected to marine water quality due to the limited amount of dredged material that would be disposed in open water under the No Action alternative. Material that would be disposed in open water would have small or no measurable concentrations of chemicals of concern (i.e., would be below PSIC values). Short-term water quality impacts would be experienced during disposal operations of any material allowed for unconfined, open-water disposal; however, these impacts are expected to be very minimal and would only occur within the specified dilution zone.

Other impacts to marine water quality can arise from two potential sources: (1) release of chemicals of concern in effluent during dewatering or from uncontrolled runoff of an upland or nearshore confined disposal site, and (2) release of chemicals of concern via leachate from confined sites which

1/Tables 4.2a, 4.2b, and 4.2c contain the estimates of material that would likely be placed in unconfined, open-water disposal for each of the three main embayments, under the No Action alternative. Table 4.2d provides these estimates for the entire Phase I area.

TABLE 4.2a

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON DISPOSAL OF FUTURE DREDGING VOLUMES

Commencement Bay (CB) and vicinity
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could Be Discharged at the Designated CB Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Managment Condition			
I	3,929	1,348	2,581
II	3,929	3,160	769
III	3,929	3,776	153

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas	Volume to Confined Disposal
No Action 3/ (PSIC) 4/	3,929	225	3,704

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

TABLE 4.2b

Elliott Bay (EB) and vicinity
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could Be Discharged at the Designated EB Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Managment Condition			
I	10,525	3,113	7,412
II	10,525	3,374	7,151
III	10,525	6,162	4,363

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas	Volume to Confined Disposal
No Action 3/ (PSIC) 4/	10,525	1,350	9,175

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

TABLE 4.2c

Port Gardner (PG) and vicinity
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could Be Discharged at the Designated PG Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Managment Condition			
I	4,943 5/	2,212	2,731
II	4,943 5/	4,684	259
III	4,943 5/	4,943	0

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas	Volume to Confined Disposal
No Action 3/ (PSIC) 4/	4,943 5/	675	4,268

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

5/Not involved is the 3.3 million c.y. of dredged material associated with the U.S. Navy Homeport project at Everett.

TABLE 4.2d

Total Phase I Area
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could Be Discharged at the Designated Phase I Unconfined Open-Water Disposal Sites1/	Volume to Confined Disposal2/
Site Managment Condition			
I	19,397 5/	6,673	12,724
II	19,397 5/	11,218	8,179
III	19,397 5/	14,881	4,516

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas	Volume to Confined Disposal
No Action 3/ (PSIC) 4/	19,397 5/	2,250	17,147

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would not be violated. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10). It is anticipated that as source control improves and project-specific experience and data become available, the portion of future dredged material that is suitable for unconfined, open-water disposal will go up.

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material would not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

5/Not included is 3.3 million c.y. of dredged material that is associated with the U.S. Navy Homeport project at Everett.

could enter ground water that eventually seeps to marine waters. Impacts from these sources on marine water quality could be significant, but would likely be localized to the area around outfalls or seeps. The degree of chemicals associated with effluents can be controlled through a variety of technologies, including construction of wiers and settling ponds.

(b) Freshwater and Ground Water. Impacts to freshwater and ground water quality can arise from two potential sources: (1) release of chemicals in effluent during dewatering or from uncontrolled runoff, and (2) release of chemicals via leachate from confined sites which could enter ground water. Impacts from effluent or uncontrolled runoff will depend on the type of water (e.g. "hard" versus "soft") and the existing water quality of the receiving waters. The degree of chemical release associated with effluents can be controlled through a variety of technologies including construction of wiers and settling ponds.

Significant adverse impacts to ground water are possible from the production of leachate containing chemicals at the disposal site. Because of the geochemical changes that are associated with drying and oxidation, a large proportion of the individual dredged material chemicals may be mobilized. This potential for leachate concern exists even with dredged material that is suitable for unconfined, open-water disposal, due to the geochemical changes that occur in air. Impacts associated with leachate chemical release will be greater under the No Action alternative than all the action alternatives. The magnitude of the impact of leachate production on ground water quality will depend on the chemical composition and physical characteristics of the dredged material, the characteristics of the interfacing soils, and the planned use of the underground receiving waters. Both inorganic and metal species, as well as organic compounds, may impact ground water quality through leachate production (Mang et al., 1978; Canter et al., 1977).

Compared to the other alternative site management conditions, the No Action alternative has the potential for greater volumes of material to be placed on land. The consequent risks to ground water are proportionately greater for several reasons. First, greater volumes will affect more acreage, and will increase the potential for releases to the ground water. These additional acres (and likely additional sites) can concommitantly decrease the degree of regulatory and technological control and monitoring at the sites. Second, though the mean concentration of chemicals released into the ground water could be higher with smaller volumes of more contaminated material than with larger volumes of less contaminated material, the mass release rate of contaminants is substantially higher with the latter simply due to magnitude of the release. Further, mixing to achieve a true mean concentration is rarely achievable. Consequently, the more material that is placed on land, even if of lower mean chemical concentration, the greater the potential risk to ground water resources.

The degree of ground water chemical release due to leachate production can be controlled through a variety of technologies including leachate collection systems and construction of liners which inhibit production and movement of leachate to ground water. Leachate production can be reduced by placing

dredged material below the water table (usually more of an option for nearshore/intertidal disposal), which can reduce mobilization of particle-bound contaminants, preventing contact with air. Although control technologies exist for ground water protection, the costs associated with their construction can be prohibitive. The need for such control technologies must be determined on a sediment-specific, project-specific basis.

(2) Marine and Estuarine Sediments. Very little impact to marine and estuarine sediments is expected under this alternative, again because of the relatively small volume of material that would be placed unconfined in open-water areas. No significant increase in sediment chemical concentrations in deepwater of the Sound would be expected since material disposed in open water under this alternative would have to meet PSIC chemistry values.

For land and shore disposal, adverse impacts might occur at the outfall of the effluent discharge where fine particles associated with the effluent would settle. These impacts could be substantially avoided by providing controls to reduce release of suspended particles and particle-bound contaminants during dewatering and by limiting rain water runon and runoff.

(3) Air Quality. Under the No Action alternative, air quality could be impacted by the upland and nearshore placement of material dredged from the Puget Sound. Sources of impact can arise from the direct volatilization of chemicals from the dredged material during dewatering and drying, and through the transportation of contaminated particles with fugitive dust as the surface of the disposal site dries and is reworked by the wind or heavy equipment. Such potential problems may require capping or planting to control dust production.

Release of hydrocarbon combustion products in exhaust emissions from trucks and other heavy equipment also would be expected to impact air quality at the immediate site of constuction and disposal activity. The impact of exhaust emissions on local air quality would depend upon site-specific factors (rural versus urban).

Overall impact to air quality is expected to be minor, of short-term duration, and confined to the area around the disposal site.

(4) Land. Disposal of dredged material under this alternative could significantly impact land development and values in the Puget Sound Region. Over the period 1985-2000, approximately 17.1 million c.y. of material under the No Action alternative would require confined upland and nearshore disposal. An estimated 1,063 acres of nearshore and/or uplands would be needed to handle this material (table 4.3). The amount of land actually available and environmentally and publicly acceptable for use as disposal sites is limited. This could prevent some projects from being undertaken.

Currently, little shoreline is available as fill area for dredged material. Any development of remaining nearshore area for dredged material disposal sites would potentially result in significant adverse impacts to nearshore lands and their ecological value. Between 1970 and 1980, 76 percent of the material dredged by the Corps was placed in upland/nearshore fill sites (most of these sites were nearshore areas). From 1980 to 1985, the percentage of

TABLE 4.3

ESTIMATED LOSSES OF LAND AND SHORE HABITAT 1/
(ACRES OF LAND/SHORE)

	Port Gardner	Commencement Bay	Elliott Bay	Phase I Area
Condition I	101	96	274	471
Condition II	10	29	266	305
Condition III	0	5	162	167
No Action 2/ (PSIC)	264	230	569	1,063

1/For purposes of this analysis, average depth of land/shore disposal sites is assumed to be 10 feet.

2/Most dredged material (almost 90%) would be placed on land or in nearshore sites for the No Action alternative. For the other alternatives, some will be discharged at confined aquatic sites (CAD), while the rest will be placed in land or nearshore sites. For purposes of this analysis, 60 percent of the volumes requiring confined disposal are assumed to be headed to land/shore, the remaining 40% would be placed in CAD sites.

LOSS OF BOTTOM HABITAT AT THE
PSDDA SELECTED DISPOSAL SITES 3/

	Acres Lost	Percent of Bay
No Action (PSIC)	0 (at public site)	not applicable)
Commencement Bay	310	6
Elliott Bay	415	6
Port Gardner	318	2
TOTAL	1,043	0.3 of Phase I area 4/

3/See DSS TA (1987) for an estimation of disposal material spread at the open-water sites.

4/Phase I area encompasses about 500 square miles of marine waters (500 square miles = 320,000 acres; 1043/320,000 = 0.003).

dredged material being placed in upland/nearshore areas dropped to 46 percent. The primary reason for this drop was the lack of acceptable sites due to public opposition to usage of valuable nearshore lands, and concerns over loss of habitat for aquatic species (principally salmonids) and water birds. Therefore, of the 1,063 acres estimated under this alternative to be needed for nearshore/upland disposal, most of it would likely be upland, because of the significant adverse impacts usually associated with developing nearshore areas.

b. Impacts and Their Significance to the Biological Environment.

(1) Flora.

(a) Marine and Intertidal. Little impact to marine and intertidal species is expected under the No Action alternative. Impacts that would occur to intertidal and subtidal macroalgae and eelgrass would primarily be due to the introduction of short-term pulses of suspended materials from effluent outfalls that could interfere with photosynthesis by reducing light availability. This impact would be minor, confined to the area around the outfall, and can be reduced through proper control of effluent discharge.

(b) Terrestrial. Potentially significant adverse effects to terrestrial plants may be associated with dredged material disposal under this alternative, since most dredged material would require confined disposal in upland or nearshore environments. Site preparation results in complete destruction of the existing habitat, including removal of vegetation and possibly excavation of top soil (which can be used to construct dikes, berms or stored for later use as a soil cap, Canter, et al., 1977). The impacts to plant communities under the No Action alternative are greater than those associated with the action alternatives considered because of the amount of land required for construction of disposal sites.

Following disposal, land sites may still result in adverse impacts to plants recolonizing the area. High salt content and the presence of chemicals of concern may hinder successful germination and growth of most plant species. In addition to slowing or preventing reestablishment of plant communities on site, vegetation around the perimeter of the disposal area may also be acutely impacted as a result of salt seepage (Harrison and Chisholm, 1974).

Once a disposal site is no longer in use, remedial action can be undertaken to rehabilitate the land, although this is often difficult and costly to accomplish (Grosselink, 1973). Sites can be seeded with saline-resistant plants or covered with enough top soil to act as an effective barrier between establishing plants and the dredged material. Additionally, dredged material can be deep plowed and limed to enhance soil conditioning prior to establishment of vegetation (CZRD, 1978).

The uptake and accumulation of chemicals of concern in the tissue of plants established on dredged material can also result in adverse effects to animals utilizing the site as a foraging area. In turn, these animals can act as vectors in the transport of chemicals off the disposal site.

(2) Plankton.

(a) Marine Phytoplankton. Only temporary impacts to marine plankton are expected under the No Action alternative, as only small volumes of relatively clean dredged material would be placed at open-water sites. Impacts to phytoplankton could result from intermittent pulses of suspended material that could interfere with photosynthesis by shielding light and stimulate growth by temporarily raising dissolved inorganic levels in the water column. Because of the small volumes and low chemical loads expected with dredged material allowed for open-water disposal, no chemical associated impacts would be expected. The overall impacts on primary production would not be significant and would be less than those associated with the other alternatives considered.

(b) Zooplankton. Little impact to zooplankton is expected under the No Action alternative, as only small volumes of material clean (meeting PSIC values) would be placed at open-water sites. Primary impacts to zooplankton would result from suspended particles physically interfering with feeding mechanisms. In addition, zooplankton in the immediate area of disposal activity could become entrained by dredged material with resultant mortalities. The overall impacts on zooplankton are not expected to be significant, should be of short duration, and would typically only occur within the allowed zone of mixing. Impacts to zooplankton under this alternative would be less than under other alternatives considered.

(3) Invertebrates.

(a) Benthic Infaunal Resources. Marine invertebrate communities will be impacted by open-water disposal activities undertaken with this alternative. Impacts will primarily be temporary loss of benthos due to burial and smothering by clumps of cohesive dredged material that reach the bottom. Since disposal activity in any one area would be of short duration and material disposed would be relatively free of chemicals of concern, rapid recolonization and recovery of the disposal area would be expected.

(b) Intertidal. Intertidal invertebrates would be impacted by any development of the nearshore environment for use as confined disposal sites. Physical impacts to sedentary species from dredged material disposal would result in the immediate loss of intertidal communities due to burial during disposal activity.

Impacts also would be possible on intertidal benthic species located outside the diked area and near the effluent outfall. Effects observed at the nearshore site outfall are expected to be sublethal in nature, depending on whether dredged material contains chemicals in concentrations of concern.

(c) Mobile Crabs and Shrimp Resources. Few impacts would be expected to mobile invertebrate resources under this alternative. Impacts to shrimp and crab resources would be limited to some short-term burial. This impact would be minor and would not adversely impact Puget Sound crab and shrimp resources. No impacts would be expected due to dredged material chemicals.

(4) Fish.

(a) Anadromous Fish. No adverse effects to anadromous fish due to unconfined, open-water disposal are expected under the No Action alternative. However, significant impacts to anadromous fish could occur under the No Action alternative if nearshore habitat areas are used as disposal sites for dredged material. Development of nearshore habitat for confined disposal of dredged material would permanently remove the area as valuable habitat for juvenile salmonids. Outmigrating juvenile salmon use shallow water nearshore areas as feeding habitat, as well as using these areas to provide cover from predators. Construction of dikes designed to contain dredged material reduces the extent of shallow water bottom surface available as feeding habitat. The density of preferred prey items and the diversity of species are reduced through disposal site construction nearshore. Any further reduction in undeveloped nearshore habitat could significantly influence survival of juvenile salmonids.

Impacts to outmigrating juvenile salmon can also occur through the accumulation of chemicals obtained feeding upon benthic and epibenthic species found near effluent outfalls associated with nearshore disposal operations (Malins et al., 1986). Juvenile salmonids are opportunistic carnivores, feeding primarily upon epibenthic invertebrates. Effluent outfall areas represent disturbed benthic zones often inhabited by dense aggregations of pioneering benthic invertebrate communities. Such benthic communities can act as a feeding attractant and, if chemicals of concern are present, could act as a major source of chemical exposure to juvenile salmonids.

Changes in water quality associated with effluent discharge might also alter or delay local migration. Impacts due to effluent discharge can be minimized through a variety of control technologies designed to reduce losses of associated particles and contaminants from the disposal site.

(b) Bottom Fish Resources. Little impact to bottom fish resources is expected under this alternative as only a small area of feeding habitat would be affected by open water disposal. Disposal of material could temporarily reduce benthic resources through burial; however, the impacted area would recolonize and again be available as foraging habitat for bottom fish.

For nearshore disposal, adverse effects to bottomfish resources can be comparable to those experienced by anadromous fish resources. Loss of habitat and possible effects near outfalls are associated with this disposal option.

(c) Freshwater Fishes. Significant adverse impacts to freshwater fish species are possible with the disposal of dredged material under the No Action alternative. Almost all dredged material would require confined disposal in upland and nearshore environments. Disposal of dredged material in upland environments can result in exposure of freshwater fish to resuspended dredged and to dissolved material chemicals that would not necessarily be released if left in a marine environment. Impacts to freshwater fish would be

a direct result of the introduction of effluent or leachate discharge into freshwater habitats. Two sources of impacts are associated with effluent discharge: (1) impacts due to increases in turbidity and siltation, and (2) impacts due to increases in chemical concentrations.

Fish species in general, and freshwater game fish in particular, have a low tolerance for increases in turbidity (Canter et al., 1977). Fish mortality due to asphyxiation is often the result of the coating effect of fine particles settling on the gill filaments (Sherk and O'Connor, 1975). Eventual reduction in fish population size and even local species elimination have been found as a result of increasing turbidity levels in streams that typically had low background levels of suspended solids (Hollis et al., 1964).

Another significant adverse impact due to turbidity and siltation on fish populations is through the reduction in spawning ground habitat (Hollis et al., 1964). Ripe running fish will abandon previously used spawning grounds if siltation is too great. Siltation will result in suffocation of fertilized eggs by reducing oxygen exchange across the egg surface.

Freshwater fish are generally more sensitive to chemicals than are marine species, and are therefore more susceptible to chemicals associated with effluent runoff from confined disposal sites. In addition, toxic metals are more readily available to organisms in freshwater than in saline waters, in effect increasing the exposure consequence.

The impacts associated with both turbidity and chemical release can be reduced with the use of wiers and holding ponds which act to limit particulate loads prior to discharge.

(5) Terrestrial Wildlife. Significant adverse impacts to terrestrial wildlife may be associated with this alternative. Development of upland and nearshore confined disposal sites could involve the destruction of wildlife habitat. The types of wildlife and number of species impacted by site construction would depend on the specific type of habitat being destroyed. Disposal site construction on an open field would impact generally smaller-sized animals and relatively less diverse communities than would be expected if forested land were utilized as sites for confined disposal. The significance of the impact to terrestrial species will depend upon the availability of nearby habitat (and its carrying capacity) to assimilate displaced wildlife.

Following the life of the disposal site, the land could become usable once again as habitat for wildlife, providing the land were reclaimed. Acute and sublethal chronic effects could become significant in animals utilizing the site if plants recolonizing the site accumulate chemicals from the dredged material.

(6) Birds.

(a) Water Birds. A variety of birds utilize Puget Sound marine waters and shoreline for nesting habitat and feeding. Shorebirds, such as

turnstones, sandpipers, and herons, are exclusively nearshore in distribution while other types of water birds, such as waterfowl, gulls, terns, and seabirds are found in both nearshore and open bay habitats. The most significant impact of the No Action alternative on waterbirds would be the possible loss of shoreline habitat and feeding grounds in those areas where nearshore disposal sites are constructed.

In addition to losses in habitat and feeding grounds, some contaminant transfer to water birds can be expected in those species feeding on invertebrates that recolonize dredged material with the chemicals of concern deposited in nearshore areas.

(b) Terrestrial Birds. Terrestrial birds could be adversely impacted under this alternative because of a reduction in suitable habitat due to construction of confined upland and nearshore disposal sites. Following reclamation of the area after the life of the disposal site, sublethal chronic impacts to terrestrial species could occur due to ingestion of plants and animals that have accumulated chemical from the dredged material.

(7) Marine Mammals. No significant impact is expected on porpoise, whales, harbor seals, and sea lions that utilize Puget Sound due to the No Action alternative. Food sources for these species are not found at depths associated with probable disposal sites (greater than 200 feet). Water column effects (due to turbidity plume) to food organisms would not significantly impact feeding by these mammals since any effects on food organisms would be localized and of short-term duration. Indirect impacts could result from loss of salmonid habitat (development of nearshore land into disposal sites) which could reduce the number of salmonid fish, one of the food sources utilized by marine mammals.

(8) Endangered and Threatened Species. There are four endangered marine mammals, one endangered bird, and one threatened bird found in the Puget Sound area. All but one of these species have limited potential to be impacted by disposal activities undertaken with this alternative, depending on where the material is placed. The four marine mammals, all whales, do not utilize the shallower waters along the shoreline as habitat or as feeding grounds. The one endangered bird species, the peregrine falcon, maintain no active eyries in the Phase I areas of Puget Sound.

On the other hand, the threatened bird, the bald eagle, may experience adverse impacts from disposal activitites under this alternative if habitat (forested areas) is taken to create upland disposal sites. Although it is established that bald eagle reproduction has been seriously affected by biologically amplified concentrations of chlorinated hydrocarbons and their metabolic derivatives, it is unknown whether chemicals associated with dredged material might be amplified in the food chain and affect bald eagles. Eagles feed on a wide variety of prey items including fish, birds, mammals, and invertebrates. Toxins from any particular group of prey (such as those species found at an upland disposal site) would not significantly impact this species providing animals from the disposal site do not account for a disproportionate share of

the diet of the bald eagles. Of all the alternatives considered in the DEIS, the No Action alternative presents the greatest risk of potential impact to bald eagles. The significance of this potential impact would depend on the location of the disposal site(s).

c. Impacts and Their Significance to the Human Environment.

(1) Social Economic. Some impact could be anticipated over existing conditions regarding waterborne commerce movements in the Phase 1 study area and related port terminal and industrial development. Impacts would be due to delays in dredging cycles and abandonment of some dredging projects because of the costs associated with dredging and dredged material disposal under this alternative. The significance of these impacts may include loss of jobs and property tax base devaluation. The Dredging and Disposal Activity paragraph presents a comparative analysis of the costs associated with this alternative. Impacts to land and beach use could also be expected if nearshore and upland sites are developed on preferred recreational sites.

(2) Transportation.

(a) Navigation. Delays in dredging (due to costs associated with dredged material disposal in upland/nearshore sites), would have an adverse impact on navigation activity due to channel shoaling. For those that elect not to dredge their harbors and waterways, shoaling would eventually reach the point that commercial and recreational traffic would be impaired, causing severe regional socioeconomic hardships to both the private and public sectors. The high cost of confined disposal relative to unconfined disposal (three to ten times more expensive), would result in some projects being held in abeyance. Because data were not available for specific projects, the analysis contained in the EIS does not address this situation. The analysis presumes that all forecasted dredged material will be removed and placed in a disposal site.

While potentially significant, the foregone benefits (for new projects) and economic impacts (for maintenance projects) of not dredging are similarly dependent on project-specific factors. With available information, it is not possible to quantify these potential adverse effects of No Action.

(b) Land. Impacts to land transportation would be the greatest under this alternative since all dredged material not delivered to a nearshore disposal site by pipeline would have to be trucked to the disposal site. Truck hauls and traffic congestion could impact normal traffic flow under this alternative more than the other alternatives which allow for greater use of unconfined, open-water disposal.

(3) Dredging and Disposal Activity. The impact of the no action alternative on dredging and disposal activity would be dependent on the availability of upland and nearshore confined disposal sites, and the costs associated with disposing of most dredged material at confined sites. Both of these factors would influence on the feasibility of a specific dredging project.

Public, multiuser, large capacity confined disposal sites are not presently available in the Puget Sound area. In the past, nearshore areas (tidelands and fill for piers, etc.) and upland sites were used on a case-by-case basis depending on site availability. Acquisition and preparation of sites suitable for accepting 88 percent of the Phase I material projected to be dredged by the year 2000 would likely be cost prohibitive.

Tables 4.4 through 4.7 display the estimated costs of dredged material testing, dredging and disposal, compliance inspections, and environmental monitoring for the alternative site conditions and the No Action alternative. Total costs and costs per cubic yard are presented by site and for all of the Phase I area. Per table 4.6, total costs of taking most of the forecasted dredged material to confined disposal is about $331 million. Costs associated with dredging and disposal under the other alternatives considered ranged from $150 million (Site Condition III) to $268 million (Site Condition I).

(4) Native American Fishing. If significant portions of nearshore areas are used as disposal sites, this could impact Native American "usual and accustomed grounds and stations" used for fishing. Stations for setting stationary gill nets could be reduced with the construction of shoreline disposal sites. Contrary to short-term impacts to salmonid fisheries that are possible with unconfined, open water disposal of dredged material, any losses of shoreline associated with this alternative would be permanent.

The potential for traffic conflicts between dredged material disposal activities and Indian fishing would be minimal under this alternative as few barges would be going to open-water disposal sites. There may be some traffic conflicts during nearshore disposal when barges are used to transport material to the site.

Impacts to biological resources of concern to Native Americans is covered under Section 4.02.b., Impacts and Their Significance to the Biological Environment.

(5) Non-Indian Commercial and Recreational Fishing. The very limited unconfined, open-water disposal activity that could result with the No-Action alternative would produce few, if any, adverse effects to non-Indian fishing activities. Nearshore confined disposal sites, on the other hand, could result in displacement of shoreline sports fisheries. The potential for this displacement to occur, and the severity of the effects, would depend on specific site locations.

(6) Human Health.

(a) Via Seafood Consumption. No impact on human health is anticipated from the consumption of seafood impacted by disposal activities under this alternative. Little unconfined, open-water disposal of dredged material would take place and the material allowed for open-water disposal would be relatively free of chemicals of concern. Some impacts might occur due to chemicals associated with effluent discharge from confined disposal sites; however, such impacts would be localized to the immediate site of the discharge.

TABLE 4.4

TESTING, DREDGING AND DISPOSAL, COMPLIANCE AND MONITORING COSTS FOR THE ALTERNATIVE DISPOSAL SITES

	Costs ($1,000)				
	Testing 1/	Dredging & Disposal 2/	Compliance 3/	Monitoring 4/	Total
Commencement Bay:					
Condition I	980	46,953	159	252	48,344
Condition II	820	21,658	373	547	23,398
Condition III	726	13,058	446	1,234	15,465
No Action (PSIC)	1,430	62,630	38 5/	0 6/	64,098
Elliott Bay:					
Condition I	5,068	159,736	367	234	165,405
Condition II	4,979	155,746	398	433	161,556
Condition III	3,874	113,285	727	692	118,578
No Action (PSIC)	3,674	186,572	225 5/	0 6/	190,471
Port Gardner:					
Condition I	1,131	52,311	261	227	53,930
Condition II	1,194	16,862	553	495	19,104
Condition III	1,210	13,148	583	1,088	16,029
No Action (PSIC)	1,730	74,352	112 5/	0 6/	76,194

1/Testing costs included cost of coring, chemical testing, biological testing (aquatic and land) QA/QC, and administration.

2/Dredging and disposal costs include cost of dredging, hauling, and disposal of material, both for material to unconfined, open water and that going to upland/nearshore/aquatic capped disposal sites.

3/Compliance inspection costs result from ensuring that dredging contractors are complying with disposal site use requirements. Compliance inspection costs were estimated by a given fee per c.y. of material that would be disposed at the open-water sites under each option. For each option, it was assumed that 60 percent of the volume would be for projects under 15,000 c.y. (the break even volume to reach the minimum charge of $2,000), and inspection costs were assumed at $0.15 per c.y. For the remainder of the volume, the $0.07 per c.y. was used to estimate costs. No regulatory agency compliance inspection costs (fees) were assumed for confined disposal as these costs would be included within the total project costs incurred by the dredged for the confined disposal site.

4/Monitoring costs are those costs associated with monitoring the unconfined, open-water disposal sites under PSDDA site condition II. Costs for PSDDA Condition I assume no full monitoring level of effort, only partial level of effort every 5 years. Costs for PSDDA Condition III assume full monitoring every 2 to 3 years. No regulatory agency monitoring costs (fees) were included for upland/nearshore confined disposal sites for the same reason that compliance inspection costs were excluded.

5/Compliance inspection under PSIC is expected to be minimal. The Phase I area cost of $375,000 is considered the minimum effort required to conduct compliance inspections over a 15-year period.

6/Monitoring of unconfined, open-water disposal sites is not required under PSIC.

TABLE 4.5

TESTING, DREDGING AND DISPOSAL,
COMPLIANCE AND MONITORING COSTS FOR THE PHASE I AREA

Alternative	Costs ($1,000)				
	Testing 1/	Dredging & Disposal 2/	Compliance Inspection 3/	Monitoring 4/	Total
Condition I	7,179	259,001	787	712	267,679
Condition II	6,993	194,266	1,324	1,475	204,058
Condition III	5,810	139,492	1,756	3,014	150,072
No Action (PSIC)	6,834	323,553	375 5/	0 6/	330,762

1/Testing costs included cost of coring, chemical testing, biological testing (aquatic and land), QA/QC, and administration.

2/Dredging and disposal costs include cost of dredging, hauling, and disposal of material, both for material headed to unconfined, open water and that going to upland/nearshore/aquatic capped disposal sites.

3/Compliance inspection costs result from ensuring that dredging contractors are complying with disposal site use requirements. Compliance inspection costs were estimated by a given fee per c.y. of material that would be disposed at the open-water sites under each option. For each option, it was assumed that 60 percent of the volume would be for projects under 15,000 c.y. (the break even volume to reach the minimum charge of $2,000), and inspection costs were assumed at $0.15 per c.y. For the remainder of the volume, the $0.07 per c.y. was used to estimate costs. No regulatory agency compliance inspection costs (fees) were assumed for confined disposal as these costs would be included within the total project costs incurred by the dredged for the confined disposal site.

4/Monitoring costs are those costs associated with monitoring the unconfined, open-water disposal sites under PSDDA site condition II. Costs for PSDDA Condition I assume no full monitoring level of effort, only partial level of effort every 5 years. Costs for PSDDA Condition III assume full monitoring every 2 to 3 years. No regulatory agency monitoring costs (fees) were included for upland/nearshore confined disposal sites for the same reason that compliance inspection costs were excluded.

5/Compliance inspection under PSIC is expected to be minimal. The Phase I area cost of $375,000 is considered the minimum effort required to conduct compliance inspections over a 15-year period.

6/Monitoring of unconfined, open-water disposal sites is not required under PSIC.

TABLE 4.6

SUMMARY OF SITE-SPECIFIC TOTAL COSTS FOR THE ALTERNATIVE SITE MANAGEMENT CONDITIONS 1/

	Site Condition			
Site	Condition I	Condition II	Condition III	No Action (PSIC)
Commencement Bay	$48,344,000	$23,398,000	$15,465,000	$64,098,000
Elliott Bay	165,405,000	161,556,000	118,578,000	190,470,000
Port Gardner	53,930,000	19,104,000	16,029,000	76,194,000
Total Costs	$267,679,000	$204,058,000	$150,072,000	$330,762,000

1/Options include the three alternative site conditions under PSDDA and the EIS No Action alternative (use of PSIC). Assumptions and derivation of these costs are contained in EPTA.

TABLE 4.7
SUMMARY OF COSTS PER CUBIC YARD FOR EACH DREDGING AREA ($/C.Y.) 1/

	Port Gardner	Elliott Bay	Commencement Bay
Site Condition I			
Unconfined	3.50	5.50	3.60
Confined	17.20	19.90	17.00
Site Condition II			
Unconfined	3.30	5.30	3.40
Confined	17.30	20.00	17.00
Site Condition III			
Unconfined	3.30	5.30	3.40
Confined	17.10	19.80	16.90
No Action (PSIC)			
Unconfined	4.60	6.50	4.70
Confined	17.20	19.90	16.90

1/Unit costs are derived in EPTA. In addition to those assumptions listed in EPTA, costs per cubic yard were derived by assuming that unconfined, open-water disposal would be the initial preference for all projects. This resulted in allocating the majority of testing costs (e.g., sampling and chemical testing) shown in EPTA to the unconfined option; only "land biological testing" was allocated to confined disposal. All compliance and monitoring costs were allocated to unconfined, open-water disposal. Costs are rounded to the nearest $0.10.

(b) Via Drinking Water. When marine/brackish, dredged material containing chemicals of concern is placed in a confined nearshore or upland disposal facility, the potential exists to generate leachates that could have an adverse effect on ground water and surface drinking water. This can occur even with material that is suitable for unconfined, open-water disposal due to geochemical changes on land. Under the No Action alternative, most dredged material would be placed in a confined site. Because of this, the potential for major impacts on drinking water supplies exists, especially if design features such as leachate collection systems, effluent control, or runoff control are not used or fail. The relative potential for drinking water contamination is greater under this alternative than it is under the other alternatives.

(c) Via Inhalation of Dust. Dredged material placed on nearshore and upland disposal sites provides a potential source of dust with chemicals of concern that could have an impact on the health of workers at disposal sites where material is being depositied and reworked. Inhalation of dust can also be a problem at closed disposal sites that are being prepared for alternate uses. The impacts to human health from inhalation of dust with chemicals can be minimized by application of suitable ground cover.

(d) Via Direct Exposure. Little direct exposure to contaminated dredged material is expected. The only segment of the population that might be expected to come into direct contact with dredged material are workers directly involved in dredging operations or at upland and nearshore disposal facilities.

(7) Noise. Few noise impacts are expected at open-water disposal sites because of the low level of open-water disposal activity expected under the No Action alternative. The most significant noise impacts would occur with activities associated with upland and nearshore disposal operations. Truck hauls would be greatest under this alternative and an increase in noise level could occur, commensurate with the increase in activity around designated disposal sites. The significance of these noise impacts will depend on whether the sites are located in rural or urban/industrial areas.

(8) Esthetics. Disposal operations at open-water sites are not expected to significantly affect the esthetic quality or experience in Puget Sound. Open-water disposal would not occur to a significant degree since a very little volume of dredged material would be disposed under this alternative at open-water sites. When open-water disposal does occur, operations will be only a minor part of marine activities.

Esthetic qualities on land, however, could be significantly impacted by disposal operations under this alternative. Viewers may be distracted by development of confined upland or nearshore disposal sites and by the operations activity that would occur during disposal. The degree of impact on esthetic quality will depend on disposal site placement. Sites developed in industrialized areas are likely to not have as great an impact as sites developed in open or forested land or along shorelines.

(9) Historic Impacts. As part of the disposal site identification mapping studies, a literature search was undertaken to establish if any historically significant shipwrecks were located within the Phase I area (see

DSSTA). Many were identified, but none within the selected and alternative disposal sites. In March 1988, additional literature review and sidescan sonar studies were made of the three selected sites. The Commencement Bay and Port Gardner sites were confirmed as being free of shipwrecks. However, shipwrecks were found at the Elliott Bay site. Further studies are underway here to mitigate for potential adverse impacts in close coordination with the State of Washington Office of Archaeology and Historic Preservation (see EIS exhibits C and D).

d. Cumulative Impacts. A variety of cumulative effects to the environment could occur under the No Action alternative. These are described separately as effects that are due to unconfined, open-water disposal and effects that are due to confined disposal of material defined as unacceptable for unconfined, open-water disposal.

Only a very small quantity of the dredged material (with the lowest concentrations of chemicals of concern) is expected to receive open-water, unconfined disposal under this alternative. Disposal of this material would not result in unacceptable adverse effects to the marine resources of Puget Sound due to chemicals in the sediment. However, since individual sites would be established by each dredger, a large number of disposal sites are possible from the No Action alternative. Physical impacts from disposal could be significant with a large number of sites. If disposal occurred at separate locations, a worst case of 7,200 acres of bottom habitat could be disturbed each year compared to a total of approximately 1,000 acres of bottom habitat that would be disturbed at the three selected multiuser sites as proposed.

(The 7,200-acre figure assumes that 150,000 c.y. of material are disposed each year in 100 separate dumps of 1,500 c.y. each, and that deposition occurs over 72 acres per dump as described by the numerical dump model, see section 2.03.h.(1). In reality, many projects would dispose greater than the 1,500 c.y. assumed, and fewer individual disposals would occur, so that fewer acres would actually be disturbed. Still, there is a potential for physical disturbance of the largest overall area, and of higher value habitat areas, under the No Action alternative.)

Permitting authorities would only allow open-water disposals to occur if, individually, their adverse impacts would not be significant. However, this would be determined on a case-by-case basis, and less overall control or consideration would be given to whether cumulative physical effects were becoming significant. Because the only material that could be disposed in water would have at most only very low (background) chemical concentrations, full recovery from any physical benthic habitat disturbance would occur rapidly. It is therefore considered that open-water cumulative effects would not be likely to become significant for the No Action alternative.

In contrast, cumulative effects due to confined disposal of 17.1 million c.y. of dredged material would be more significant than under any other alternative. The most significant contribution to cumulative effects resulting from open-water disposal would derive from construction and operation of nearshore disposal sites. The construction of such sites could affect valuable shoreline habitats that serve a variety of critical functions to different life

history stages of many important Puget Sound species. Such sites can also affect wetland habitats that not only serve many critical functions, but have already suffered significant levels of cumulative effects both in the Puget Sound region and nationally.

An estimated 1,063 acres of upland/nearshore habitats are likely to be required in the PSDDA Phase I area for confined disposal under this alternative (table 4.3). To the extent that the habitats described above are included with this acreage in future permit requests, a variety of impacts could occur. Nearshore disposal could contribute to cumulative impacts on spawning and juvenile rearing habitat for marine and anadromous fish, spawning and cover habitat for commercially important invertebrate species such as Dungeness crab and shrimp, habitat for shellfish such as clams and oysters, and feeding for shorebirds. Disposal at upland sites could potentially affect ground water quality via leachate with chemicals of concern, surface water quality if runoff carries chemicals from the sites, and freshwater aquatic resources if surface water quality is degraded to the point that long- or short-term toxic effects occur. In addition, losses of upland habitats themselves can be significant, if high value habitats cannot be entirely avoided when selecting the sites.

Until studies can be undertaken to identify multiuser confined disposal sites, it will not be possible to determine the degree to which upland, nearshore, or wetland habitats may actually be affected. However, the No Action alternative has the potential to affect the greatest amount of these habitats because it would require the greatest volume of material to receive confined disposal.

e. Relationship to Existing Plans, Policies, and Controls.

(1) Clean Water Act, Sections 404/401. Because of the low chemical levels expected in material allowed for unconfined, open-water disposal under the No Action alternative, identification of suitable disposal sites would also likely be consistent with 404(b)(1) guidelines. Consistency of all upland/nearshore disposal sites to 404(b)(1) guidelines would need to be evaluated on a project-by-project basis. The same is true for State water quality certification pursuant to Section 401 of the CWA.

(2) Coastal Zone Management. The Coastal Zone Management Act (CZMA) (Public Law 91-583: 86 Stat. 1280) was passed by the United States Congress in 1972. In June 1976, the State of Washington Coastal Zone Management Program (CZMP) was approved to receive funding allowing the CZMA to be implemented via the State Shoreline Managment Act (SMA) of 1971. As passed by the State legislature, the SMA provides "for the management of Washington's shorelines by planning and fostering all reasonable and appropriate uses." The SMA is implemented through detailed planning efforts that culminated in the Shoreline Master Programs (SMP) for the large municipalities and counties of the State. Consistency of the No Action alternative with the SMA and the current State CZMP, and satisfying consistency with State and Federal CZM requirements, would depend on where unconfined, open-water disposal sites were located. Dredging projects which could affect other lands under jurisdiction of CZMP would have to be evaluated on a project-by-project basis.

(3) Shoreline Master Program. Open-water disposal sites for dredged material allowed under the No Action alternative would be obtained from the appropriate local shoreline jurisdiction, on a case-by-case basis.

(4) Department of Natural Resources (DNR) Policy on Open-Water Disposal of Dredged Material into Puget Sound. Under the No Action plan, no multiuser sites would be available. Although no designation of a general use site would be made by DNR, any proposal for an open-water disposal action would likely require review and approval by DNR.

(5) Executive Order 11990, Protection of Wetlands. The intent of Executive Order 11990 is to protect wetlands because of the significant cumulative losses that have occurred, and due to their high value to biological productivity and their many other critical functions. Wetlands could be directly affected by the No Action alternative. Dredging projects which could affect wetlands would be evaluatated on a project by project basis at the time the project is reviewed for permits under Section 404 of the Clean Water Act. The No Action alternative would increase the likelihood of filling wetlands with dredged material relative to other alternatives.

(6) Executive Order 11988, Flood Plain Management. The intent of Executive Order 11988 is to provide guidance and regulation for projects located in, and affecting, the flood plain. E.O. 11988 requires, to the extent possible, avoidance of long- and short-term adverse impacts associated with occupancy and modification of flood plains. Disposal of dredged material in upland and nearshore sites could impact a flood plain; however, disposal siting would need to be evaluated on a site-by-site basis to ensure compliance with E.O. 11988.

(7) Puget Sound Water Quality Comprehensive Plan. The Puget Sound Water Quality Comprehensive Plan was adopted 17 December 1986. The contaminated sediment and dredging program of the plan contains a sediment program goal "to reduce and ultimately eliminate adverse effects on biological resources and humans from sediment contamination throughout the Sound by reducing or eliminating discharges of toxic contaminants and by capping, treating, or removing contaminated sediments." The plan also adopts the following policies which shall be followed by all State and local agencies in actions affecting sediment quality, including rulemaking, setting priorities for funding and actions, and developing permit programs:

> "All government actions will lead toward eliminating the presence of sediments in the Puget Sound basin that cause observable adverse effects to biological resources or pose a serious health risk to humans."
>
> "Programs for management of dredging and disposal of sediments should result in a net reduction in the exposure of organisms to adverse effects. (The intent of this policy is that dredging and disposal contribute to the cleanup of the Sound by allowing unconfined, open-water sites to have only low levels of contamination and to dispose of more contaminated sediments in a manner that prevents continued exposure

of organisms to adverse effects. For proposals where dredging will expose contaminated sediments, project-specific mitigation measures may be required."

"Remedial programs (which may include capping inplace) shall be undertaken when feasible to reduce, with the intent of eliminating, the exposure of aquatic organisms to sediments having adverse effects."

The No Action alternative fully complies with the above goal and policies. Dredged material discharged in the Sound would not contain chemicals of concern at levels that would result in observable adverse effects to biological resources.

(8) American Indian Religious Freedom Act. The American Indian Religious Freedom Act of 1978 (AIRFA) requires Federal agencies to ensure that none of their actions interfere with the inherent right of individual Native Americans (including American Indians, Eskimos, Aleuts, and Native Hawaiians) to believe, express, and exercise their traditional religions. These rights include access to religious sites, use and possession of sacred objects, and the freedom to worship through traditional ceremonials and rites. The AIRFA requires consultation between Federal agencies and Native Americans to ensure that federally supported projects or projects on Federal land do not infringe on the religious practices of Native Americans.

Coordination between PSDDA agencies and potentially affected tribes has occurred throughout the study, and is an ongoing process.

ENVIRONMENTAL EFFECTS OF THE
ALTERNATIVES CONSIDERED FOR COMMENCEMENT BAY

4.03 Alternative CB1-II: Commencement Bay Site 1 with Site Condition II - Selected Alternative. The final EIS alternatives evaluated for the Commencement Bay area are listed in table 4.8.

a. Impacts and Their Significance to Physical Environment.

(1) Water Quality.

(a) Marine Water. Unconfined, open-water disposal activities at the selected site will probably not significantly affect water quality conditions in Commencement Bay (i.e., currently Class A waters) except in the immediate vicinity of the disposal site during disposal operations.

Some short-term water quality impacts are anticipated following disposal activities from bottom dumped barges. This is due to elevated levels of suspended solids within the dredged material plume. Water quality monitoring of the experimental disposal site in Elliott Bay during and after disposal operations showed no significant long-term impacts to water quality for up to 9 months (Baumgartner et al., 1978; Schell et al., 1978; Pavlou et al., 1978). Transient impacts observed included elevated levels of PCB (i.e., increases from 3 ng/l to as high as 3 ug/l), d-Mn, and NH3-N, which were all associated with increased suspended solids levels and were short term (generally minutes) in duration. No important chemical changes in the water column were documented during disposal activities at the Columbia River ADFI site located off the mouth of the Columbia River, or at other sites throughout the country during the Dredged Material Research Program (DMRP) (Wright 1978).

TABLE 4.8

FINAL EIS ALTERNATIVES EVALUATED FOR COMMENCEMENT BAY

EIS Alternative	Description	Addressed in EIS Section
CB1-II	Commencement Bay Site 1 and Site Condition II (selected alternative)	4.03
CB2-II	Commencement Bay Site 2 and Site Condition II	4.04
CB1-I	Commencement Bay Site 1 and Site Condition I	4.05
CB1-III	Commencement Bay Site 1 and Site Condition III	4.06
Selection of Commencement Bay alternative		4.07

Though a suggested source of chemical contribution to the sea surface microlayer, dredged material chemical input to the microlayer has not been verified or quantified, but is not considered significant relative to other probable sources from permitted discharges (e.g., sewage effluent) (Word and Ebbesmeyer, 1984; Word, et al., 1986; Hardy and Cowan, 1986). Contributions to the sea surface microlayer will continue to occur from a variety of sources, including airborne sources (dry particulate fallout, precipitation, gases, and animal materials, land sources (including shoreline erosion, river runoff, discharge of sewage and industrial effluents, and spills from vessels and land based facilities), and nearshore sediments (through upwelling, bubbles, or biochemical transformations). Observations of shoreline contamination in Puget Sound strongly implicate sewage discharges and street runoff as primary causative agents (Word and Ebbesmeyer, 1984). A review of the literature on sea surface microlayer composition, sources, and impacts on phytoplankton and phytoneuston is presented in a PSDDA report prepared Word, et al., 1986. To ensure that dredged material disposal does not result in the release of unacceptable concentrations of chemicals into the water column, the PSDDA evaluation procedures call for water column testing if warranted on a case-by-base basis.

In addition to the above impacts, suspended dredged material may become incorporated in the nepheloid layer that is found near the sediment/water interface. A quantitative estimate of the amount of disposed material that might become associated with the nepheloid layer is not possible, however, the level of contribution is not expected to be significant. Indirect evidence of dredged material contribution to the nepheloid layer was suggested in research conducted during the Corps Field Verification Program in Long Island Sound. Benthic species near the experimental disposal site exhibited increased levels of certain chemicals during disposal activities. Following disposal, however, tissue residue values dropped to background levels in organisms collected near the site (FVP study, 1987). The PSDDA monitoring program for the open-water sites calls for collection of tissue residue data for benthic species collected off the disposal site to further evaluate potential impacts due to the nepheloid layer (contributions).

In conclusion, only transient and temporary changes in suspended solids levels and increased levels of sediment-bound chemicals are expected during disposal activities. Significant adverse impacts to water quality are not expected.

(b) Freshwater and Ground Water. Impacts to freshwater and ground water quality can arise from two potential sources: (1) release of chemicals in effluent during dewatering or from uncontrolled runoff, and (2) release of chemicals via leachate from confined sites which could enter ground water. Impacts from effluent or uncontrolled runoff will depend on the type of water (hard versus soft) and the existing water quality of the receiving waters. The degree of chemical release associated with effluents can be controlled through a variety of technologies including construction of wiers and settling ponds.

Significant adverse impacts on ground water may result from the production of leachate containing chemicals of concern at the disposal site. Because of the geochemical changes that are associated with drying and oxidation, a large fraction of sediment chemicals can be mobilized. The magnitude of the impact of leachate production on ground water quality will depend on the chemical composition and physical characteristics of the dredged material, the characteristics of the interfacing soils, and the planned use of the underground receiving waters. The relative potential for freshwater and ground water chemical release under this alternative is less than the impacts that would be predicted if Site Condition I had been selected for unconfined, open-water disposal sites and greater than the impact if Site Condition III had been chosen.

(2) Marine and Estuarine Sediments. A numerical model was used to predict the fate of dredged material disposed in open water and to provide an estimate of the area over which material might spread. The model employed bathymetry and tidal current conditions representative of Commencement Bay site 1 (Trawle and Johnson, 1986). Estimates of disposal patterns of dredged material developed by the numeric models were used to define the disposal boundaries. The long-term disposal pattern for Commencement Bay site 1 is expected to be a circle, concentric with the 1,800-foot diameter disposal zone boundary (DSS TA, 1987). The disposed material would have a diameter of approximately 4,000 feet; however, the disposal model data indicate that the vast majority of material from each disposal will be deposited in an area measuring approximately 1,000 feet in diameter, covering approximately 20 acres. The overall size of the disposal site will be governed, however, by the amount of material being deposited, sediment bulking factors, material characteristics that govern stable side slopes of the disposal mound, effects of bottom slopes, and settlement characteristics.

Site capacity is not expected to be exceeded in the foreseeable future. An estimate of site capacity, based on flat bathymetry, can be made assuming that the shape of the disposal mound at capacity can be approximated by a truncated cone with a base diameter of 4,000 feet (disposal site boundary), a height of 34 feet (3.4 percent angle of repose), and a diameter at the top of the cone equal to 2,000 feet (DSS TA, 1987). A truncated cone with this geometry has a volume equal to approximately 9 million c.y. It was assumed that bulking effects which take place during dredging and disposal operations will be offset by the long-term consolidation of the disposal mound. This assumption equates to a one-to-one ratio of dredged volume to site capacity volume. Since all three Phase I sites have areas at least equal to a circle having a diameter of approximately 4,000 feet, each has capacity in excess of 9 million c.y. Assuming that an annual average of the volume that could be discharged at the selected Commencement Bay site over the period 1985-2000[1/] is experienced beyond the year 2000, the 9 million c.y. capacity would be reached in the year 2028.

1/See table 4 2a.

Surface sediments at Commencement Bay site 1 are primarily fine mud and clays (Hileman and Matta, 1983; DSS TA, 1987) and the site appears to be one of net deposition. Material expected to be disposed at the open-water site will range in grain size from primarily silt and clays (Commencement Bay waterways) to material that is primarily sand (Carr Inlet, Ruston-Point Defiance Shoreline) (Tetra Tech, 1986). Forecasts of dredging activity for the Commencement Bay area, however, indicate that most of the material dredged will be from the waterways that are predominantly composed of silt and clays. Although some changes in grain size distribution at the disposal site can be expected due to disposal of Commencement Bay area dredged material; however, these impacts are not expected to have a significant adverse impact on the sediments of the area.

Sediment chemistry analyses of samples from the area of site 1 outside the probable impact area of the existing disposal site did not reveal elevated levels of chemicals of concern. The chemical levels were found to be generally similar to other areas in outer Commencement Bay (Hileman and Matta, 1983). Chemical levels at site 1 are generally lower than levels that could be discharged at the unconfined, open-water disposal sites under Site Condition II. See section b., "Impacts and Their Significance to Biological Environment" for a discussion of the possible impacts to biological resources due to potential increases in sediment chemicals.

(3) Air Quality. No significant loading of concern chemicals to the existing air environment is anticipated as a result of forecasted disposal activities at the preferred site in Commencement Bay. Tugboat towing of barges to the disposal site is expected during the normal 20-25 days of average annual usage. During this usage, about one to two barges/day would be discharging at the site, with peak activity of five barges/day (table 4.9).

Some hydrocarbon releases, including hydrocarbon byproducts and particulates from diesel fumes would be released during disposal activities at both the open-water disposal site and at upland/nearshore sites. Negligible concentrations of hydrogen sulfide gas may also be released from the dredged material during open-water disposal activities. In summary, no significant impacts are anticipated to the air quality environment in Commencement Bay as a result of disposal activities due to the selected alternative.

(4) Land. Habitat losses associated with dredged material that must be placed in all disposal sites (benthic/land/shore/confined) could include loss of benthic habitat, wetlands, loss of fish feeding and rearing habitat, loss of land vegetation, and loss of natural shoreline areas (see sections 2.04 and 4.02 above). An estimate of habitat losses was developed for the Commencement Bay selected alternative (table 4.3), and indicating that approximately 310 acres of benthic habitat would be covered by the selected disposal site, while land and shore losses would approximate 29 acres. It is not possible to further distinguish between upland and nearshore losses since development of either would depend on relative site availability. The Commencement Bay area has several previously identified areas with capacity for disposal (Phillips et al., 1985). Additionally, with existing navigation proposals for filling of outmoded slips and waterways, potential nearshore

TABLE 4.9

ESTIMATED USE AT UNCONFINED, OPEN-WATER DISPOSAL SITES

Site	Average Annual Disposal Site Use1/ (days/year)	Maximum Average Rate of Use2/ (barges/day)	Peak Rate of Use3/ (barges/day)
Commencement Bay	20 - 25	1 - 2	5
Elliott Bay	45 - 50	2 - 4	10
Port Gardner	30 - 35	2 - 3	5

1/Estimated site use is for normal dredging activity and is based on the mid-range of disposal volumes used in the environmental monitoring fee analysis (see MPTA, exhibit 1). Proposed large navigation improvement projects, e.g., Duwamish and Blair-Sitcum, which might require substantial dredging, are not included here. Impacts of these projects would be evaluated separately in project environmental documents. The estimates take into consideration that not all dredged material that is acceptable for unconfined, open-water disposal will be discharged at the designated public disposal sites.

2/Average level of activity during those days of actual site use.

3/Peak level of activity during those days of actual site use.

sites are also relatively available providing that site development meets environmental requirements for disposal of dredged material.

The significance of these losses will depend on the ecological value and previous uses of the land prior to its use as a dredged material disposal site. The open-water site used for unconfined disposal is expected to be recolonized following cessation of disposal activity (see Section 4.03.b.(3)(a), Benthic Infaunal Resources). Land sites that are developed for human use (e.g. disposal sites), however, are usually permanently lost from ecological production unless extensive effort is put into the reclamation. Development of nearshore areas could result in significant adverse losses of salmonid feeding habitat.

b. Impacts and Their Significance to Biological Environment.

(1) Flora.

(a) Marine and Intertidal. Little impact to marine and intertidal species is expected under this alternative. Impacts that would occur to intertidal and subtidal macroalgae and eelgrass would primarily be due to the

introduction of short-term pulses of suspended materials from effluent outfalls that could interfere with photosynthesis by reducing light availability. This impact would be expected to be minor and confined to the area around the outfall and can be reduced through proper control of effluent discharge. Relative impacts under this alternative would be less than those predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites and greater than impacts if Condition III had been chosen.

(b) Terrestrial. Significant adverse impacts to terrestrial plants can result with disposal of dredged material at confined upland sites. Site preparation requires complete destruction of the existing habitat including removal of vegetation and possibly excavation of top soil (which can be used to construct dikes, berms or stored for later use as a soil cap) (Canter et al., 1977). Under this alternative, approximately 29 acres of upland and nearshore area would be used to develop confined disposal sites. The impacts to plant communities under this alternative are greater than those associated with Condition III and less than the impacts associated with Condition I.

Following disposal, land sites may still present significant adverse impacts to plants recolonizing the area. High salt content and the presence of chemicals may hinder successful germination and growth of many plant species. In addition to slowing or preventing reestablishment of plant communities on site, vegetation around the perimeter of the disposal area may also be acutely impacted as a result of salt seepage (Harrison and Chisholm, 1974).

Once a disposal site is no longer in use, remedial action can be undertaken to rehabilitate the land, although this is often difficult to accomplish (Grosselink, 1973). Sites can be seeded with saline resistant plants or covered with enough top soil to act as an effective barrier between establishing plants and the dredged material. Additionally, dredged material can be deep plowed and limed to enhance soil conditioning prior to establishment of vegetation (CZRD, 1978).

(2) Plankton.

(a) Marine Phytoplankton. Impacts to phytoplankton would result during disposal operations from intermittent pulses of suspended material that could either promote and inhibit primary production. Turbid mixtures of organic and inorganic material both interfere with photosynthesis by shielding light and stimulate growth by raising inorganic nutrient levels above background levels. Impacts can also occur from suspended materials adhering to the surfaces of cells, interfering with gaseous/nutrient transport across the cell wall, possibly leading to mortalities. Also, phytoplankton in the path of the descending dredged material mass would be removed from the euphotic zone and lost (flocculated). The release of growth inhibitory substances from the dredged material may also occur. Concern chemicals released during disposal could result in inhibition of photosynthesis by interfering with metabolic pathways.

As disposal operations would not occur during the major portion of the spring bloom period due to closing for fishery protection, the high phytoplankton productivity at that time of the year would not be significantly impacted. Disposal would occur, however, during the fall bloom period, so that impacts to the phytoplankton community may be somewhat more pronounced then during other times of the year. The overall impacts on primary production would be localized, are likely not measurable, and are not expected to be significant.

(b) Zooplankton. Impacts to zooplankton could result from suspended particles interfering physically with active feeding. In addition, suspended particle loads would dilute the concentration of food particles in the water for filter feeders and, in some instances, reduce the amount of available food (due to flocculation of phytoplankton).

Zooplankton in the immediate disposal area could become entrained by the disposal material with resultant mortalities. However, most zooplankton are spatially distributed in the water column over wide area and any impacts at the disposal site would not be expect to significantly affect Commencement Bay zooplankton community structure.

Any impacts to the Commencement Bay zooplankton community would be localized and short term. Chemicals released from the disposal operation may have measurable, although short term and localized impacts. Localized impacts could include mortality, inhibition of growth and reproduction. However, the temporal nature of the disposal and the small percentage of zooplankton impacted relative to the existing bay-wide community, would render this impact insignificant.

(3) Invertebrates.

(a) Benthic Infaunal Resources. Two types of impacts would occur as a result of dredged material disposal at the selected PSDDA open-water site: (1) physical impacts, and (2) chemical impacts. Each is discussed in turn with respect to probable impacts to the sedentary benthic infaunal resources existing within the disposal site and immediately adjacent to it.

Anticipated physical impacts to sedentary benthic infaunal resources resulting from dredged material disposal in the selected site would include the immediate, but temporary, loss of benthos due to burial and smothering by clumps of cohesive material within the relatively small single dump bottom impact area ("250-foot diameter," see section 2) of the overall disposal site. Direct physical impacts from dredged material hitting the bottom will be greatest in the center of the impact zone and diminishing to negligible impacts toward the edges of this zone. It is likely that some of the buried infauna will be able to survive initial burial by vertically migrating out of deposited material, particularly if they are covered by less than 20 centimeters (cm) of material. Several benthic infaunal species have demonstrated the ability to

migrate vertically and survive burial induced by relatively thick covers (i.e., up to 50 cm) of sediments with particle size distributions both similar to, and different from, their preferred sediment habitat (Maurer et al., 1978).

During periods of dredging inactivity, partial recovery of benthos due to recruitment and migration from surrounding unimpacted areas can be expected. Likely recruits to the disposal site may consist of polychaete opportunists such as Capitella capitata, Spiophanes fimbriata, and Boccardia polybranchia (Battelle Draft Report to EPA: Detailed Chemical and Biological Analysis of Selected Sediments From Puget Sound, 1985) as well as from resident bivalve species, such as Axinopsida sericata, and Macoma carlottensis. Recolonization may result in the partial restoration and/or possible enhancement of benthic habitat values to foraging bottom fishes (Rhoads et al., 1978; Becker 1984). Tatum (1984) reported an increase in benthic species abundance at an experimental disposal site in Elliott Bay following disposal operations. Additionally, a recent BRAT survey of the Foul Area disposal site off the coast of New England showed that benthic resource food values on site were increased as a result of disposal activities relative to offsite conditions for many of the target flatfish foraging strategies examined, particularly fish foraging for smaller prey living near the sediment-water interface (Lunz, 1986).

Existing benthic communities found on site are adapted to fine-textured, medium silt/coarse silt bottoms. Potential changes in bottom sediment grain size distribution resulting from dredged material disposal would likely have a detrimental impact on many of the resident infaunal species (i.e., due to lower reproductive potential, impaired recruitment success, and survival of young) as well as negatively influence the ability of buried adults to vertically migrate and survive burial (Maurer, et al., 1978).

Under the effects definition for Site Condition II (see section 2), some sublethal impacts to onsite benthos are possible from chronic exposure to dredged material. These impacts are not expected to extend beyond the disposal site. The PSDDA monitoring program includes an analysis of benthic community health around the disposal site to ensure that biological impacts are not occurring off the disposal site. The severity and extent of biological effects from the Site Condition II are not expected to be significant, since the majority of the taxa found at the selected site (polychaetes, bivalves; Clarke, 1986) are not known to be acutely sensitive to chemicals of concern. Effects associated with Site Condition II may include sublethal impacts within the disposal site. Potential increases in the mortalities of the more sensitive, but less abundant, crustacean species may also occur (see section 3.02(b)(1)(b)). However, these are not considered to be unacceptable adverse effects.

Cumulative effects of exposure to the dredged material could result in a reduction in population and community biomass of equilibrium (Stage III) species, with a corresponding increase in abundances and biomass of more pollution and physical disturbance tolerant pioneering (Stage I) species. This pattern will also be maintained by the periodic physical disturbance of the site during disposal operations. Tissue concentrations of contaminants may also increase in onsite benthos exposed to the dredged material.

Impacts that occur off of the site would not be significant, consisting of food web impacts, and possibly sea surface microlayer impacts. The former involves mobile benthos (crab, shrimp, etc.) feeding on disposal site benthos and migrating off of the disposal site with a chemical body burden and, perhaps, chronic effects, and contributing chemicals via predation or decomposition to the bay food web. The degree of food web transfer is unknown, but should not be significant, due to the nature of the site management condition and because few mobile species are present in this area. Nearshore, intertidal and subtidal invertebrate fauna would not be significantly impacted from the disposal operations due primarily to their distance from the disposal site. Existing sea surface microlayer chemicals may occasionally contact the nearshore benthos as a result of currents, tidal actions, and wind moving chemicals onshore. In the case of Commencement Bay site 1, the probability that contaminants from the disposal material would significantly contribute to the existing sea surface chemical load, with sig- nificantly increased impacts, is considered low (Word and Ebbesmeyer 1985; Word et al., 1986; Hardy 1986).

(b) Intertidal. Intertidal invertebrates would be impacted by any development of the nearshore environment for use as confined disposal sites. Physical impacts to sedentary species from dredged material disposal would be the immediate loss of intertidal communities due to burial during disposal activity. Effects observed at the nearshore site are expected to be sublethal in nature if material disposed in the nearshore environment contains chemicals in concentrations characterized as Site Conditon II. Some acute impacts could be expected if dredged material exceeds Site Condition II. Species impacted would include copepods and gammarid amphipods, which can comprise 30 to 40 percent (by abundance) of the species present in intertidal communities. Chemical impacts are expected to be localized to the area immediate to the effluent outfall. Overall impact to intertidal communities would be dependent on both the amount of nearshore area taken for disposal site use and the level of chemicals in the material disposed.

(c) Mobile Crab and Shrimp Resources. As no Dungeness crab (*Cancer magister*) were caught in the selected disposal site, it is assumed that they are not present there (or, if present, are present in very low numbers). Disposal operations at the site would not impact Dungeness crab at any time of year. Impacts on shrimp would be primarily burial in the immediate disposal site. This impact would be minor as only low densities of shrimp occur at the site regardless of season, and Commencement Bay shrimp populations would likely not be significantly impacted. Repeated disposal events could eventually lead to mortalities of the migrant survivors due to physical impacts.

Possible onsite impacts could be due to exposure of shrimp immigrating to the site with subsequent chronic, sublethal effects, including bioaccumulation, and possibly reproductive, and other physiological impacts. Again, because of the low numbers of shrimp that utilize the site, overall potential impact to bay shrimp resources is considered insignificant.

(4) Fish.

(a) Anadromous Fish. Impacts of disposal operations on important juvenile salmon populations will be negligible, primarily because no disposal operations will occur between March 15 and June 15, the "window" designated by the Washington State Department of Fisheries to protect juvenile salmon during downstream migration. The majority of the juvenile salmon populations will have migrated out of Commencement Bay by June 15.

Disposal would occasionally be coincidental with the presence of early or late migrants (especially chinook salmon) or with those species that may tend to remain in the bay for extended periods of time (e.g., searun cutthroat trout). These juveniles would not be impacted by the disposal operations unless they frequented the disposal area where they could pass through the turbidity plume and be subject to turbidity impacts. Impacts could include interference with oxygen exchange due to suspended solids clogging gill surfaces, and slightly lowered oxygen availability due to biological oxygen demand of the suspended dredged material that forms the disposal plume. Impacts to juveniles due to exposure to chemicals in the plume would probably be negligible as most chemicals would be unavailable, bound to the sediment particles, rather than dissolved in the water column where they could be absorbed across gill surfaces. These impacts, if they occurred at all, would be minor since juveniles typically avoid disposal plumes, and the site is not located in primary juvenile migratory pathways.

Adult salmon and trout migrating through the bay would also not be significantly impacted by disposal operations as the majority of the fish would avoid disposal-associated turbidity plumes. Those fish that contact the plume, however, would be temporarily impacted from short-term clogging of their gills by suspended material, and from slight depressions in dissolved oxygen due to the biological oxygen demand of the dredged material. However, these conditions are far less severe than the fish encounter when they migrate up the Puyallup River which has a high content of silt due to glacial runoff in the summer and fall and highwater and floods in the winter.

Contribution of chemicals to the sea surface microlayer from the dredged materials may occur, but is expected to be minor relative to existing levels of chemicals from other sources (Word et al., 1986; Hardy, 1986). Actual chemicals and their concentrations would be difficult to identify/measure in view of many source contributions in Commencement Bay. Adult salmon may occasionally swim at the surface for short periods and therefore contact the microlayer during their milling behavior, however, physiological effects due to dredged material chemicals would not be expected to occur. For there to be a noticeable impact on adult salmon fished in the bay, the salmon would have to swim for extended periods of time at the surface and near to the disposal area or microlayer "plume" to absorb chemicals via the gills, possibly resulting in minor physiological impairments. Swimming at the surface for extended periods is not typical of migrating adult salmonids. In general, disposal operations involving material suitable for Site Condition II should not significantly impact physiological mechanisms/behavior patterns of adult salmon in Commencement Bay.

(b) Bottom Fish Resources. Negligible bottom fish resources were found on or near the selected site during site specific studies in September, June, and September 1986 (section 3.02(b)(3)(d)). It is therefore probable that the area in Commencement Bay occupied by the selected site does not represent prime bottomfish habitat. Nevertheless, some direct and secondary impacts to bottom fishes are expected to occur as a result of disposal of dredged material at this site. Clumps of cohesive material impacting the bottom may bury flatfish such as Dover sole within the "250-foot" diameter bottom impact zone (see section 2.03(h(1)). Any fish found outside the bottom impact zone will likely escape direct impacts, but may suffer some respiratory distress due to gill clogging and/or low dissolved oxygen levels (i.e., due to high COD/BOD levels), induced by elevated levels of suspended solids within the dredged material plume. It is highly likely that fish will avoid stressful levels of suspended dredged material by temporarily moving out of the area. In conclusion, because only low numbers of bottom fish resources were found on site, direct physical impacts from disposal on these resources are not expected to be significant.

Bottom fish resources may also be affected through secondary impacts resulting from disposal of dredged material in the preferred disposal site. Benthic communities within the impact zone are expected to be temporarily lost as a result of burial and smothering, further lowering the value of the area as food habitat for bottom fish. As this area does not appear to be a prime feeding habitat area for bottomfish in general (Clarke, 1986), the impact of this habitat loss to fish resources is not expected to be significant.

Benthic resources, however, are expected to recover during periods of disposal inactivity. Fish food habitat values might even increase as a result of increased production of pioneering (stage I) opportunistic species on the disposal mound (Rhoads et al., 1978; Becker 1984; Lunz, 1986). Bottom fish foraging on these opportunistic species may bioaccumulate chemicals through dietary intake of prey. Direct accumulation of chemicals might also occur through skin and gill membranes as a result of their intimate association with the bottom sediments, particularly when buried in the sediments. Because the area of the disposal site only represents a relatively small portion of the foraging habitat for demersal bottom feeding fish in Commencement Bay, and documented fish food habitat resources on site are uniformly low, only very low levels of chemical bioaccumulation in fish predators are possible.

(c) Freshwater Fishes. For disposal of material unacceptable for unconfined, open-water disposal, impacts to freshwater fish could result from the introduction of effluent discharge from upland confined disposal sites into freshwater habitats. Two sources of impacts are associated with effluent discharge: (1) impacts due to increases in turbidity and siltation, and (2) impacts due to increases in chemicals.

Fish species in general, and freshwater game fish in particular, have a low tolerance for increases in turbidity (Canter et al., 1977). Fish mortality due to asphyxiation is often the result of the coating effect of fine particles settling on the gill filaments (Sherk and O'Connor, 1975). Eventual reduction in fish population size and even local species elimination have been found as a result of increasing turbidity levels in streams that typically had low background levels of suspended solids (Hollis et al., 1964).

Another possible impact due to turbidity and siltation on fish populations is through the reduction in spawning ground habitat (Hollis et al., 1964). Ripe running fish will abandon previously used spawning grounds if siltation is too great. Siltation will result in suffocation of fertilized eggs by reducing oxygen exchange across the egg surface.

Freshwater fish are generally more sensitive to chemicals of concern than are marine species and are therfore more susceptible to chemicals associated with effluent runoff from confined disposal sites. In addition, toxic metals are more readily available to organisms in freshwater than in saline waters, in effect increasing the exposure environment. The relative potential for impacts to freshwater fish under this alternative is less than the impacts that would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal site and greater than the impact if Condition III had been chosen.

(5) Terrestrial Wildlife. Development of upland and nearshore confined disposal sites would require the destruction of wildlife habitat and cause significant adverse impacts to terrestrial wildlife. The types of wildlife and number of species impacted by site construction would depend on the specific type of habitat being destroyed. Disposal site construction on a field would impact generally smaller-sized animals and relatively less diverse communities than would be expected if forested land were utilized as sites for confined disposal. The significance of the impact to terrestrial species will depend upon the availability of nearby habitat (and its carrying capacity) to assimilate displaced wildlife. Relative impacts under this alternative will be less than those predicted if Site Condition I had been chosen for the unconfined, open-water disposal site and greater than impacts if Condition III had been chosen.

(6) Birds.

(a) Water Birds. The only direct impacts of open-water disposal on waterbirds would appear to be the result of temporary turbidity, temporary loss of prey source, and potential impacts to intertidal organisms from drift of suspended dredged material. Turbidity limits visibility and makes feeding difficult, if not impossible. Turbidity from disposal activity, however, is localized and temporary. Furthermore, waterbirds will avoid the turbidity plume and feed elsewhere. Benthic resources at the disposal site are generally not utilized as food by waterbirds. Few birds dive greater than 120 feet

(cormorants and loons may), which limits the impacts to a few species. Furthermore, stomach samples of deep-diving birds indicate that bottomfish comprise only a small proportion of the total diet. Thus, these birds do not depend on bottom-living organisms, and, in fact, primarily utilize free swimming fish such as herring and smelt.

Even if the disposal areas were utilized by waterbirds and the sites did not fully recolonize, the total area of impact is small relative to the potential feeding area in Puget Sound. Waterbirds are mobile; also, the preferred site has relatively low biological productivity to begin with, such that the loss would be minimal. The potential loss of intertidal organisms from drift of suspended material is considered to be minimal and will not affect waterbirds.

The selected site is not presently nor historically an area of concentration of waterbirds. Commencement Bay's primary value to waterbirds is in the protected intertidal areas, where most of the waterbird species can find refuge and a food resource. Significant impacts could be expected to shorebirds if nearshore areas were developed as confined disposal sites.

(b) Terrestrial Birds. Terrestrial birds could be significantly impacted under the preferred alternative depending on the types of upland habitat used for construction of confined disposal sites. Impacts would be greater if forested land were used relative to cleared land because of the greater diversity of birds associated with the former. Following reclamation of the area after the life of the disposal site, sublethal chronic impacts to terrestrial birds could occur due to ingestion of plants and animals that have accumulated contaminants arising from the dredged material.

(7) Marine Mammals. No significant long-term impacts to marine mammals indigeneous to or migrating through Commencement Bay are expected from disposal of dredged material at the selected site. No marine mammals discussed in section 3.02(b)(4) are abundant in Commencement Bay, and their presence in the selected disposal site would only be a rare occurence. It is therefore probable that no significant physical or chemical impacts to marine mammals are expected. Those mammals in the vicinity of the disposal site during a disposal operation, would likely avoid the area during the dumping activity. Marine mammals feeding on bottomfishes and macroinvertebrates in the vicinity of the disposal site may accumulate small levels of chemicals concentrated in their prey, although the amount attributable to the disposal site itself would probably not be significant due to their wide ranging foraging habits and the small percentage of site use (Wright, 1978).

(8) Endangered and Threatened Species. Biological assessments have been prepared that evaluate potential impacts to bald eagles, gray whales, and humpback whales (exhibit A). The only species on the Federal list that are found in Puget Sound are the gray whale, humpback whale, peregrine falcon, and bald eagle. Gray whales are regularly, though infrequently, sighted in Puget Sound. These are considered stragglers which may or may not feed while in Puget Sound. Some of the few recent sightings of gray whales in Puget Sound have been relatively close to the preferred disposal site. In each case, the whales were present for no more than 1 day and were not seen again in the same

area. The implication is that the whales are "passing through" (and in all likelihood not feeding) and find no special attraction for any one area. It thus appears that selection of the proposed disposal areas would not impact gray whales, regardless of the sites ultimately selected. Much the same arguments can be made for humpback whales.

Peregrine falcons are rarely observed in the vicinity of any of the selected disposal areas; rarely enough, in fact, that the U.S. Fish and Wildlife Service did not include this species on its list of species that should be considered in the biological assessment. Their prey base consists of small waterbirds, primarily ducks such as teal, and shorebirds. Peregrines prefer to swoop on large flocks of such birds, where they have greater odds of finding one that is weak or confused and, hence, easy prey. Such flocks are most often in protected bays in intertidal or shallow subtidal habitats. The open-water disposal site is relatively unprotected and generally does not attract large numbers of waterbirds. The lack of such large flocks at the proposed disposal area suggests that selection of the site would not impact peregrines (since their prey base would not be affected).

Bald eagles are present throughout the year near the selected site. They feed on whatever may be present (ducks, gulls, live surface-swimming fish, dead animals washed ashore, etc.). Again, concentrations of birds or fish are helpful for prey-capture success. The selected disposal site for Commencement Bay Phase I does not have large concentrations of animals and thus feeding by bald eagles would not be affected.

Other potential affects associated with the disposal site include primarily human disturbance and noise from disposal barges. The most important consideration is that the selected site is not near regular areas of animal use. Thus, human disturbance and noise are not expected to affect any endangered species.

c. Impacts and Their Significance to Human Environment.

(1) Social Economic. Adverse impacts to waterborne commerce movements in Commencement Bay and vicinity and related port terminal and industrial development are expected to be substantially less with this alternative relative to the No Action alternative. Because of higher costs associated with dredging and dredged material disposal, dredging cycles may be extended over that experienced in the past. However, delays in dredging activity would be less under this alternative than those expected if Site Condition I were chosen for management of the unconfined, open-water disposal sites. The Dredging and Disposal Activity section (see below) presents a comparative analysis of the costs associated with dredging under the alternatives considered by PSDDA.

Impacts to sport fishing could also occur due to displacement by tugs and barges at the disposal site (see Navigation section below). In addition, impacts to land and beach use could also be expected if nearshore and upland disposal sites were developed in recreational areas. Overall, social economic impacts are not expected to be significant.

(2) Transportation.

(a) Navigation. Normal average annual dredged material disposal activity in Commencement Bay is expected to be about 20 to 25 days per year, somewhat above the level experienced over the past 15 years. Disposal activity could be considerably greater than this level for several years if the Blair-Sitcum Navigation project is undertaken. Actual activity would depend on the specific dredging projects, and the results of chemical and biological tests performed on material to be dredged. As navigation channels would be maintained, there would be no adverse impacts on navigation activity due to channel shoaling. Barge-tug movement during disposal operations is not expected to be much different than at present and consequently there should be no significant navigation conflicts with commercial or pleasure craft.

Since disposal typically is accompanied by dredging, the Commencement Bay selected site would not be used during the salmon and steelhead outmigration window: March 15 through June 15. During times of normal site use, disposal activity at the site would be expected to average about 1 to 2 barges per day, with peak activity of 5 barges per day (table 4.9).

When proceeding to the disposal site, tug and barge combinations move at a slower rate loaded than unloaded. Average travel speed is typically around 5 knots. Once on site, disposal operations within the 1,800-foot diameter disposal zone usually require between 5 and 10 minutes. On occasion, weather constraints and repositioning requirements (to ensure proper location of disposal) can increase the onsite time to as much as 20 minutes. Using an average of 10 minutes, and assuming one to two barges per day, normal site occupancy could amount to about 10 to 20 minutes per day or about 6 hours per year.

Though delays in disposal activities could result from avoiding conflicts with tribal fisheries (see below), they are unlikely, given the limited anticipated use of the site, and the existing and proposed coordination between dredgers and the tribes.

Disposal operations at the selected site would represent a slight increase in navigation traffic for the site proper. With increased water traffic, there is an increase in risk of minor oil leaks or spills, and of vessel collisions. The location of the disposal site, the infrequent site use, and the short duration of site occupancy indicate that these risks are not significant and are likely not measurable.

(b) Land. Impacts to land transportation would be considerably less than those resulting from the No Action alternative, as about 80 percent of future dredged material is expected to be found suitable for open-water disposal at the Commencement Bay site. Truck hauls and traffic congestion associated with upland disposal would be substantially less than under the No Action alternative, where most dredged material would be placed in nearshore or upland sites.

(3) Dredging and Disposal Activity. The overall impact of this alternative on dredging activity in Commencement Bay would be an increase in the volume of material found acceptable for unconfined, open-water disposal over that allowable under existing interim criteria. Currently, the suitability of material for open-water disposal in Commencement Bay is based on the Puget Sound Interim Criteria (PSIC). Using PSIC, only about 6 percent of the future Commencement Bay area material is expected to be acceptable for unconfined, open-water disposal. Under the selected alternative, 3.9 million c.y. of material (100 percent) is projected over the next 15 years to be found acceptable for unconfined, open-water disposal at the Commencement Bay disposal site (table 4.2). Actual disposal volumes will depend upon the outcome of chemical and biological tests conducted on the material and the specific projects proposed for dredging. Costs of dredging (includes testing, dredging, disposal, compliance inspections, and open-water site monitoring costs) over the next 15 years in Commencement Bay, using Site Condition II, would be approximately $23,398,000 (table 4.4). Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10). It is anticipated that as source control improves and project-specific experience and data become available, the portion of future dredged material that is acceptable for unconfined, open-water disposal will go up.

(4) Native American Fishing. The selected alternative for Commencement Bay should not increase the potential for tribal fishing gear damage and/or reduced fishing time resulting from use of the unconfined, open-water disposal site. The relatively limited amount of dredging that is conducted in Commencement Bay is likely the main reason why known conflicts have not occurred. Tribal fishing rights will be protected from disposal vessel conflicts with specific project actions accomplished via the Section 404 permit process. See section 2 for additional discussion of this issue.

Possible tribal concerns regarding the impact of the PSDDA proposal to water quality and fisheries resources upon which the tribal activities are dependent are addressed earlier in this section 4.

(5) Non-Indian Commercial and Recreational Fishing. Non-Indian fishing activities may be displaced during the discharge of dredged material at the selected disposal site. At times of major dredging activity, this displacement could persist for 5 to 10 minutes, up to five times per day. The selected disposal site has been located to minimize potential conflicts with known commercial and sports fishing activities. It is anticipated that displacements, should they occur, are more probable for sports fishermen than for commercial activities. The disposal site location and the short duration of site use, are expected to preclude any significant adverse effects to fishing activities and catch success in these waters.

(6) Human Health.

(a) Via Seafood Consumption. No impact on human health is anticipated from the consumption of seafood that might be in or near the disposal site. Only suitable dredged material will be allowed for disposal at the site. No significant impact to human health is expected with Site Condition II.

(b) Via Drinking Water. When marine/brackish, dredged material is placed in a confined nearshore or upland disposal facility, the potential exists to generate leachates having adverse impacts on ground water and surface water used for drinking. Under this alternative, material forecasted to be found unsuitable for unconfined, open-water disposal will have to be placed in a confined site. If the material is placed in a nearshore or upland facility, then potential for drinking water chemical impacts exists, especially if design features such as leachate collection systems, effluent control, or runoff control are not used or fail. Development of any upland or nearshore disposal sites, and the types of material allowed in these sites, would be subject to State and Federal regulations designed to protect drinking water sources. The relative potential for ground water chemical impacts under this alternative is less than the impacts that would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites and greater than the impacts if Condition III material had been chosen.

(c) Via Inhalation of Dust. Dredged material placed on nearshore and upland disposal sites provides a potential source of dust with chemicals of concern that could have an impact on workers and residents living around such a site. Dust production can especially be of concern at multiuser sites where the deposited dredged material is being reworked. This can also be the case at a disposal site that is being prepared for alternate uses. The impacts to human health from inhalation of dust can be minimized by the application of suitable ground cover. The relative potential for dust production under this alternative is less than would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites, and is greater than if Condition III had been chosen.

(d) Via Direct Exposure. Little direct exposure of humans to contaminated dredged material occurs. The only segment of the population that might be expected to come into direct contact with dredged material are workers on dredging crews and at upland and nearshore disposal facilities. Material that is highly contaminated could be placed in secure disposal sites where protection against exposure to chemicals would be minimized by operational procedures (i.e., wearing protective clothing and respirator, security to limit access to the site, application of coverage soil for disposal).

(7) Noise. There have been no measurements of ambient noise levels or of the actual noise at the shore which would be produced by disposal equipment operating at the Commencement Bay site. However, noise studies have been done at the shore adjacent to the Fourmile Rock disposal site in Elliott Bay that provide some estimation on the noise impact of disposal operations.

Between 20 September 1985 and 24 June 1986, eight separate noise studies were conducted in the residential area near the Fourmile Rock site by two noise consultants. Ambient noise measured between 35 and 70 dBA and averaged from 35 to 51 dBA during the different measuring periods. Noise from tugs and tug-barge combinations was measured at between 37 and 46 dBA. The average noise levels were in the low 40's. The exception was one barge which measures 58 dBA for a short time. Muffling has since been added to bring the noise level down further. In a number of cases, the noise testers reported that the tugs and barges could not be heard above ambient noise at the shore.

The selected Commencement Bay site will be at least 2,500 feet from the Commencement Bay shoreline. It is assumed that noise impacts from use of the site will be well within State and Federal noise standards and, in many cases, unnoticeable. Noise impacts at the shoreline should also be within standards set by Pierce County which allows for noise emissions from any watercraft to 80 dBA at the receiving property except between 10 p.m. and 7 a.m. when the limit at residential receiving properties is 63 dBA.

(8) Esthetics. Disposal operations are not expected to significantly affect the esthetic quality or experience in Commencement Bay and vicinity. The disposal operations will be only a minor part of the marine activities ongoing in a busy harbor/marine transport area. Viewers from the various shoreline areas identified in section 3 will see the occasional presence (between one and five times daily during normal dredging operations) of a tug and barge moving into the outer bay area, spending about 5 to 10 minutes for disposal, and leaving the area. The tug and barge will not be readily noticeable from the downtown Tacoma or inner bay areas, and should not be obtrusive to closer viewers, such as from Point Defiance Park and Browns Point. Viewers from these latter areas may observe a localized turbidity plume in the immediate vicinity of the barge immediately following disposal. This plume will be short term and may be masked at times by Puyallup River runoff during high flow periods. Some viewers may perceive the tug and barge activity in a positive sense, in that it is an integral part of normal marine activities and does not detract from the overall view experience.

(9) Historic Impacts. As part of the disposal site identification mapping studies, a literature search was undertaken to establish if any historically significant shipwrecks were located within the Commencement Bay selected or alternative disposal sites. None were identified (DSSTA). Also additional literature reviews and sidescan sonar studies were made of the selected site in March 1988, confirming the earlier review. Further coordination was and is being accomplished with the State of Washington Office of Archaeology and Historic Preservation (see FEIS exhibits C and D).

d. Cumulative Impacts. Disposal operations at the selected site may contribute to several ongoing impacts to the water and air resources that are described in section 3. Marine water quality, air quality, intertidal and subtidal macrofauna, plankton, neuston, marine mammals, anadromous and marine fishes, and threatened or endangered species could all experience some effect. None of these contributions, however, will exceed very minor levels. The only resource expected to receive measurable cumulative impacts in Commencement Bay is the disposal site sediments and the benthos that are permanent or temporary residents in those sediments.

In Commencement Bay, disposal of suitable dredged material at the selected site could potentially degrade a portion of the site's deepwater benthic habitat by increasing the levels of chemicals present in the sediments. However, sediment in that portion of the selected site that overlaps with the existing site may be improved. Since material that is substantially cleaner than that allowed under the Site Condition II will also be discharged at the site, the actual condition of the site is expected to be substantially better than Site Condition II. Overall, cumulative effects of the selected alternative are not expected to be significant.

e. Relationship to Existing Plans, Policies, and Controls.

(1) Clean Water Act, Sections 404/401. Procedures used in identifying the selected Commencement Bay disposal site and site management condition are consistent with the 404(b)(1) Guidelines for Specification of Discharge Sites for Dredged or Fill Material (40 CFR Part 230). Federal advance identification of the selected site as suitable for disposal of dredged material pursuant to part 230.80 of the Guidelines is addressed in exhibit B. The selected site and site management condition are also consistent with Ecology guidelines for State water quality certification pursuant to Section 401 of the CWA.

(2) Coastal Zone Management. The Coastal Zone Management Act (CZMA) (Public Law 91-583: 86 Stat. 1280) was passed by the United States Congress in 1972. In June 1976, the State of Washington Coastal Zone Management Program (CZMP) was approved to receive funding allowing the CZMA to be implemented via the State Shoreline Managment Act (SMA) of 1971. As passed by the State legislature, the SMA provides "for the management of Washington's shorelines by planning and fostering all reasonable and appropriate uses." The SMA is implemented through detailed planning efforts that culminated in the Shoreline Master Programs (SMP) for the large municipalities and counties of the State. The selected alternative is consistent with the SMA and the current State CZMP, satisfying consistency with State and Federal coastal zone management requirements.

(3) Pierce County Shoreline Master Program. The selected disposal site is located within the jurisdiction of Pierce County, which adopted its shoreline master program in 1979. The site lies within the shoreline environment classified as urban. Dredged material open-water disposal is listed as a permitted or conditional use. The selected alternative is consistent with the county's master program as presently written.

(4) Department of Natural Resources (DNR) Policy on Open-Water Disposal of Dredged Material into Puget Sound. Sites throughout the Puget Sound area have been designated by DNR for open-water disposal. If the dredged material cannot be beneficially utilized (e.g., creation of artificial islands, landfill), and it is approved by all of the various regulatory agencies for unconfined, open-water disposal, it can be deposited in one of the DNR sites. Fees and leases from DNR and permits from other agencies are all required before disposal of dredged material can occur. The selected Commencement Bay site will be an approved DNR open-water disposal site once the local shoreline permit has been granted by Pierce County.

(5) Executive Order 11990, Protection of Wetlands. The intent of Executive Order 11990 is to protect wetlands because of the significant cumulative losses that have occurred, and due to their high value to biological productivity and their many other critical functions. As the selected Commencement Bay site lies in water over 500 feet deep, no wetlands would be directly affected. Dredging projects which could affect wetlands would be evaluated on a project by project basis at the time the project is reviewed for permits under Section 404 of CWA.

(6) Executive Order 11988, Flood Plain Management. The intent of Executive Order 11988 is to provide guidance and regulation for projects located in, and affecting, the flood plain. Executive Order 11988 requires, to the extent possible, avoidance of long- and short-term adverse impacts associated with occupancy and modification of flood plains.

As the selected open-water disposal site lies in water over 500 feet deep, no direct flood plain impacts would be involved by use of this site. Dredging projects which could affect the flood plain would be evaluated on a project by project basis at the time the projects are reviewed for permits under Section 404 of the CWA.

(7) Puget Sound Water Quality Comprehensive Plan. The Puget Sound Water Quality Comprehensive Plan was adopted 17 December 1986. The contaminated sediment and dredging program of the plan contains a sediment program goal "to reduce and ultimately eliminate adverse effects on biological resources and humans from sediment contamination throughout the Sound by reducing or eliminating discharges of toxic contaminants and by capping, treating, or removing contaminated sediments." The plan also adopts the following policies which shall be followed by all State and local agencies in actions affecting sediment quality, including rulemaking, setting priorities for funding and actions, and developing permit programs:

> "All government actions will lead toward eliminating the presence of sediments in the Puget Sound basin that cause observable adverse effects to biological resources or pose a serious health risk to humans."
>
> "Programs for management of dredging and disposal of sediments should result in a net reduction in the exposure of organisms to adverse effects. (The intent of this policy is that dredging and disposal contribute to the cleanup of the Sound by allowing unconfined, open-water sites to have only low levels of contamination and to dispose of more contaminated sediments in a manner that prevents continued exposure of organisms to adverse effects. For proposals where dredging will expose contaminated sediments, project-specific mitigation measures may be required."
>
> "Remedial programs (which may include capping inplace) shall be undertaken when feasible to reduce, with the intent of eliminating, the exposure of aquatic organisms to sediments having adverse effects."

The selected site is located to minimize the exposure of aquatic animals to dredged material placed there. The site is relatively nondispersive and situated away from a high abundance of important aquatic species and from human use areas. Although the species potentially exposed to the dredged material at the disposal site are different from those present at the dredging site, the net effect of the dredging and disposal action could be to reduce overall exposure potential by moving the material from shallow estuarine areas to deeper marine waters.

Per the definition of the selected site management condition, the material to be discharged at the unconfined, open-water sites is not expected to pose a serious risk to human health. Though the selected condition could potentially result in some "observable adverse effect" in the form of sublethal effects to any organisms that remain onsite for an extended period of time, the discharge of substantially better (or "cleaner") material on the sites would likely result in an actual or average condition comparable to the stated plan policy.

The dredger does not typically control the original discharge of chemicals of concern into the aquatic environment. Nevertheless, the PSDDA study has highlighted the importance of the PSWQA goal relative to "reducing or eliminating discharges of toxic contaminants" into the Sound. As this goal would be achieved through improved source control, material dredged from the Sound's waterways should improve in quality, as should the condition at the disposal sites. Consequently, source control must remain a high priority for protection of the Sound.

For the reasons described above, the PSDDA selected alternative for Commencement Bay is considered to be consistent with the 1987 Puget Sound Water Quality Comprehensive Plan.

(8) American Indian Religious Freedom Act. The American Indian Religious Freedom Act of 1978 (AIRFA) requires Federal agencies to ensure that none of their actions interfere with the inherent right of individual Native Americans (including American Indians, Eskimos, Aleuts, and Native Hawaiians) to believe, express, and exercise their traditional religions. These rights include access to religious sites, use and possession of sacred objects, and the freedom to worship through traditional ceremonials and rites. The AIRFA requires consultation between Federal agencies an Native Americans to ensure that federally supported projects or projects on Federal land do not infringe on the religious practices of Native Americans.

Coordination between PSDDA agencies and potentially affected tribes has occurred throughout the study, and is an ongoing process.

4.04 Alternative CB2-II: Commencement Bay Site 2 With Site Condition II Material. The potential environmental effects of disposal of Site Condition II dredged material at the alternate site in Commencement Bay (site 2) are mostly identical to those of the selected alternative (site 1). This is a direct result of the site identification process: both sites are located in relatively nondispersive environments and are positioned to minimize disturbance to key bottom resources. In adjusting the site locations to meet these site identification factors, the final locations of the two sites now overlap. Consequently, there are very few differences in their physical, biological and human environments, and few differences in environmental effects would result by their use as dredged material disposal sites. Those differences that have been identified are described below. Environmental consequences for cumulative effects and relationship to existing plans, policies and controls by use of site 2 would be the same as those described above for site 1.

a. Impacts and Their Significance to the Physical Environment. Environmental consequences from disposal of acceptable (per Condition II) dredged material at the Commencement Bay site 2 would be the same as those described for site 1 above for water quality, marine and estuarine sediments, air quality and land. Though data from the depositional analysis suggested that site 2 might be somewhat less depositional than site 1 (DSS TA, 1987), such that effects on sediments might also be somewhat different, the close proximity of the sites and degree of similarity in their character suggest that the differences may not be measurable, and would not be significant.

b. Impacts and Their Significance to the Biological Environment. Environmental effects resulting from the disposal of acceptable (per Condition II) dredged material at site 2 in Commencement Bay would be identical to those described for site 1 above for flora, shrimp, crabs, bottomfish, anadromous fish, birds, marine mammals and threatened and endangered species. No significant differences exist between the two sites for these resources.

Available data indicate that adverse effects to benthic invertebrate species (polychaete worms, molluscs, and less mobile crustaceans) would be somewhat higher at site 2 than at site 1. This is reflected in the higher benthic biomass present at site 2 (70 g/m2 in top 15 cm) when compared to site 1 (42 g/m2). However, these observed differences are not statistically significant due to the high variability in the benthic communities at the sites. The Benthic Resource Assessment Technique (BRAT) confirmed these differences by noting that predators would see a slightly higher food value at site 2 when compared to site 1, but again not to the degree of statistical significance (DSS TA, 1987). Use of site 2 would result in the loss of these additional benthic resource values; however, for the reasons described for site 1 above, these losses are not considered significant.

c. Impacts and Their Significance to the Human Environment. Use of the Commencement Bay site 2 with suitable (per Condition II) dredged material would result in the same environmental effects as those described for site 1 for social economic values, transportation, dredging and disposal activity, Native American fishing, human health, noise and esthetic quality. This is due to the close proximity of the two alternative sites.

4.05 Alternative CB1-I: Commencement Bay Site 1 with Site Condition I Material. Analysis of the environmental consequences of the Site Condition I alternative for Commencement Bay is provided here in comparison to the effects of the preferred alternative (Level II). In general, the adverse effects of these two alternatives are similar in type, differing primarily in degree of effect in the various disposal environments. Substantially less material would be acceptable for unconfined, open-water disposal for Site Condition I than for the preferred alternative. This could result in fewer or decreased adverse effects in the aquatic environment, and additional or increased adverse effects in the land and shore environments.

Though this alternative would result in less material placed at the unconfined, open-water site, the spread of the material would cover a comparable bottom area at the site; however, the depth of cover would be less. Consequently, differences between Condition I and Condition II in their physical impacts to site species would not be significant. The major differences between Condition I and Condition II result from the different level of biological effects permitted.

In Commencement Bay, application of Site Condition I would result in substantially less material (1,348,000 c.y.) being found acceptable for unconfined, open-water disposal during the next 15 years than would be the case for Site Condition II (3,160,000 c.y.).

The following subsections describe the differences in environmental consequences that would result from the use of Site Condition I compared to those incurred by use of Site Condition II.

a. Impacts and Their Significance to the Physical Environment. Site Condition I would shift the primary water quality effects to nearshore, ground water and freshwater areas, with far fewer effects at the aquatic site compared to Site Condition II. A greater potential for chemical impacts to ground water and surface water is possible under this alternative compared to the preferred alternative, especially if design features are not used, or fail. As with Site Condition II, the effects at the unconfined site are intermittent and short-term, and are not considered significant.

Compared to Site Condition II, Site Condition I would result in minimally different physical effects and modifications of marine sediments at the unconfined site due to the similar spread and distribution of the dredged material. Under this alternative, an increase over present concentrations in sediment chemicals would be expected at the disposal site. However, due to lower chemical concentrations in the dredged material, Site Condition I would result in fewer adverse effects within the unconfined site than Site Condition II. On balance, the potential for technological control (more material would be placed in upland and nearshore sites where control technology can be more easily applied) provides the opportunity for Site Condition I to result in overall fewer adverse effects to sediment quality than with Site Condition II.

Fewer barges utilizing the unconfined site means that fewer adverse effects to air quality would result at the site. However, the transport of the material via more trucks would mean a shift of air quality impacts to the land/shore environments, in closer proximity to human use. Overall, the adverse effects of Site Condition I to air quality are considered more substantive than those of Site Condition II. Though they would vary by the site being used, they are not likely to be significant.

For the dredged material that is not acceptable for unconfined, open-water disposal under the Site Condition I option, an estimated 96 acres of land and shore habitats (see table 4.3) could be impacted in the Commencement Bay Area.

When the total estimated water and land/shore acreages are combined for each alternative, Site Condition I would result in more land (406 total acres) committed than Site Condition II (339 total acres). The overall significance of Site Condition I effects to land compared to Site Condition II would depend on the relative value ascribed to the aquatic and land/shore acreages.

b. Impacts and Their Significance to the Biological Environment. Site Condition I would result in fewer effects to aquatic flora at the unconfined site, because a smaller volume of material would be discharged at the site and this would have less potential for chemical effects. On land and nearshore environments, however, an increase in impacts to plants is possible. This is due to both an increase in acreage needed for disposal (loss of natural habitat) and placement of a greater volume of sediment with chemicals of concern in these environments. Overall, Site Condition I would result greater adverse effects to flora than for Site Condition II, because of the added impact to plants under Site Condition I.

For invertebrates, the adverse physical effects of Site Condition I would be similar at the unconfined, open-water site as those of Site Condition II, though added physical losses of intertidal and subtidal shoreline habitat would occur. Site Condition I results in fewer adverse effects to invertebrates than Site Condition II.

Aquatic marine fauna at the disposal site would be at less risk with Site Condition I than with Site Condition II. However, increased potential loss of shoreline habitat could significantly affect salmonids. The overall significance of using Site Condition I, compared to Site Condition II, depends on the relative value ascribed to these habitats and species.

As with the case for Site Condition II, minimal impacts to waterfowl are expected from the disposal of dredged material suitable for Condition I at the open-water disposal site. Because of the potential loss of additional important habitat on land under this alternative, there is a greater probability for adverse impacts to birds than with Site Condition II. The same situation exists for threatened and endangered species. Though the species at risk will differ in the water and land areas, direct loss of land habitat represents a greater risk to these protected animals than do the disturbances at the open water site.

c. Impacts and Their Significance to the Human Environment. Compared to Site Condition II, social economic impacts of Site Condition I would be primarily associated with greater land use issues and greater cost to navigation and marine-related industries. These would be associated with somewhat lesser risks to the aquatic site and greater risks to land and shore environments. In addition, truck transport of dredged material has the potential of adversely affecting traffic in and around land/shore disposal sites. Again, the overall significance of these tradeoffs depends on socially ascribed values to the impacted resources.

In Commencement Bay, the estimated volume of dredged material that would meet the Site Condition I over the next 15 years is small (1,348,000 c.y. or 34 percent of the 3,929,000 c.y. forecasted for Commencement Bay; table 4.2a). Compared with activity expected if Site Condition II were adopted, the overall impact of Site Condition I on dredging activity would be to reduce, or at least delay, initiation of new projects and ongoing navigation maintenance cycles. The primary reason for the reductions or delays would be the increase in project costs associated with having to place more dredged material (that exceeding the Site Condition I) at other disposal locations. Additional delays could result during identification, designation, acquisition, and development of upland and nearshore disposal sites. The added cost of Site Condition I in Commencement Bay is estimated at about $25,000,000 (Site Condition I: $48,344,000; Site Condition II: $23,398,000) (table 4.6).

Under this alternative, there would be less barge traffic at the open-water site, with fewer potential fishery conflicts and need to coordinate dredging activities. However, increased use of shoreline and land disposal sites could result in overall greater potential effects to resources and areas of importance to tribal fisheries. In addition, barge traffic would persist to some nearshore sites. Given the low degree of potential conflict that would exist with the unconfined, open-water site with any alternative, the increased effects on land and shore areas suggest that Site Condition I would result in more significant adverse effects to Native American concerns than would Site Condition II.

No difference in effects to human health would result from seafood consumption. Given the conservative approach applied in defining the site management conditions, Site Condition I should result in less risk to human health via seafood consumption than Site Condition II due to overall less volume and lower chemical concentrations that would go the unconfined, open-water sites. For both alternative Conditions I and II, the adverse effects to human health are not expected to be significant.

Site Condition I would increase the potential for adverse effects to human health in the land and shore environments. Increased risk of drinking water chemical impacts would result at upland sites. Dust and direct exposure to the dredged material also represent concerns at land and shore sites. By proper technology control, it is possible to limit the primary exposure to individuals that must work on or around sites during dredged material discharge and site completion or modification. Though the actual risks and effects would be site specific, on balance, Site Condition I has the potential for greater adverse effects to human health than does Site Condition II.

Noise impacts at the open-water site would be fewer with Site Condition I, but there would be measurably more noise effects at land and shore sites. Overall, the adverse effects to noise resulting from Site Condition I are considered more significant than those of Site Condition II.

d. Cumulative Effects. The location of the disposal site in Commencement Bay significantly contributes to the avoidance of direct and indirect adverse effects to important human and environmental resources. The reduced chemical loading to the sound that would result with Site Condition I relative to Site Condition II would not offset the increased loss of land and nearshore habitat that would also occur. Though the consequences to land are site specific, given past disturbances of shoreline environments, the potential exists for significant cumulative effects to occur with nearshore disposal sites. Consequently, Site Condition I has the potential for greater cumulative effects to the environment than Site Condition II.

4.06 Alternative CB1-III: Commencement Bay Site 1 With Site Condition III. Analysis of the environmental consequences of the Site Condition III alternative for Commencement Bay is provided here in comparison to the effects of the preferred alternative (Site Condition II). In general, the adverse effects of these two alternatives are similar in type, differing primarily in degree of effect in the various disposal environments. With Site Condition III, almost all dredged material would be acceptable for unconfined, open-water disposal. Of the 3,929,000 c.y. of material forecasted for dredging, only 153,000 c.y. is estimated to be found unacceptable per Site Condition III. This would result in additional or increased adverse effects in the aquatic environment, and a decrease in adverse effects in the land and shore environments.

Though this alternative would result in more material placed at the unconfined, open-water site, the spread of the material would cover a comparable bottom area at the site. Consequently, differences in physical impacts to site species would not be significant. The major differences between Site Condition III and Site Condition II result from the different level of biological effects permitted due to chemicals in the dredged material.

In Commencement Bay, application of Site Condition III would result in more volume (3,776,000 c.y.) of material found acceptable for the unconfined, open-water disposal sites in the next 15 years than for Site Condition II (3,160,000 c.y.) (table 4.2a). The following subsections describe the differences in environmental consequences that would result from the application of Site Condition III compared to those incurred by use of Site Condition II.

a. Impacts and Their Significance to the Physical Environment. Site Condition III would shift the primary water quality effects from nearshore, ground water and freshwater areas, to the aquatic site compared to Site Condition II. Water quality at the open-water disposal site could experience overall greater adverse effects with the Site Condition III alternative. Potentially significant contributions to the sea surface microlayer and nepheloid layer are more possible with Site Condition III. As with Site Condition II, however, the effects at the unconfined site are expected to be intermittent and short term, and are not considered significant.

Compared to Site Condition II, Site Condition III would result in similar physical effects and modifications of marine sediments at the unconfined site due to the volume and grain size distribution of the material. This would

result in a similar spread and distribution of the dredged material. However, due to higher chemical concentrations present in the dredged material, Site Condition III could result in greater biological effects at the unconfined site than Site Condition II. Sediment quality could be significantly altered by use of Site Condition III, which may possible lead to unacceptable adverse effects on biological resources. On balance, there is greater potential for Site Condition III to result in adverse biological effects than with Site Condition II.

More barges would utilize the unconfined site; however, the increase in barge traffic relative to that for Site Condition II would not be significant and would not result in any change in impact to air quality at the open-water site. The reduction in transport of the material via more trucks would mean a shift of air quality adverse effects from the land/shore environments to the water environment. Overall, the adverse effects of Site Condition III to air quality are considered less substantive than those of Site Condition II. Though they would vary by the site being used, they are not likely to be significant in most cases.

For dredged material that is not acceptable for unconfined, open-water disposal under Site Condition III, an estimated 5 acres of land and shore habitats (see table 4.3) could be impacted in the Commencement Bay Area. Additionally, confined aquatic disposal sites would result in further modification of bottom area. When the total estimated water and land/shore acreages are combined for each alternative, Site Condition III would result in less land (315 acres) committed than Site Condition II (339 total acres). The overall significance of Site Condition III effects to land compared to Site Condition II would depend on the relative value ascribed to the aquatic and land/shore acreages.

b. <u>Impacts and Their Significance to the Biological Environment</u>. Site Condition III would result in more adverse effects to aquatic flora at the unconfined site, and potentially less adverse effects to plants and terrestrial animals in land and shore areas, than with Condition II.

For invertebrates, the adverse physical effects of Site Condition III would be greater at the unconfined, open-water site as those of Site Condition II. A greater number of species would be expected to exhibit acute and chronic effects with Site Condition III than with Site Condition II. Crab and shrimp populations found in the area may also be significantly impacted by disposal using Site Condition III, relative to Site Condition II, because of the greater concentration of chemicals and potential for increased risk to the nepheloid layer.

For birds, terrestrial wildlife, and threatened and endangered species, there would be an overall reduction in impact associated with Site Condition III compared to Site Condition II. For aquatic species listed as threatened or endangered, risks would be higher; however, the area around the open-water site is not utilized by these species.

c. Impacts and Their Significance to the Human Environment. Compared to Site Condition II, Site Condition III would reduce the number of land use issues, as open-water disposal would be the primary method for disposal of dredged material. Land issues that remain, however, could be locally significant because dredged material that does not meet Site Condition III requirements would have to be placed at a confined site.

In Commencement Bay, the estimated volume of dredged material that would meet the Site Condition III over the next 15 years is 3,776,000 c.y. Compared with activity expected if Site Condition II were adopted, no overall impact of Site Condition III on dredging activity would be expected. The cost of Site Condition III in Commencement Bay would be approximately $15,465,000, compared to $23,398,000 for Site Condition II (table 4.6).

With Condition III activity, there would be more barge traffic at the open-water site, with a greater potential for sport fishery conflicts and need to coordinate dredging activities. However, the increase in volume of material that would be suitable at the open-water site, relative to Site Condition II would not be great enough to expect a significant increase in barge traffic. The decreased use of shoreline and land disposal sites could result in lowering the adverse effects to resources and areas of importance to tribal fisheries. In addition, minor barge traffic may persist to some nearshore sites, as well as to a possible confined aquatic disposal site.

There would be no different effects to human health resulting from the seafood consumption route via Site Condition III. However, given scientific uncertainties in chemical effects though conservative, it can still be said that Site Condition III would result in greater risk to human health via seafood consumption than Site Condition II due to overall greater volume and higher chemical concentrations that would go to the unconfined, open-water sites. For both alternatives, the adverse effects to human health are not expected to be significant.

Site Condition III would significantly decrease the potential for adverse effects to human health in the land and shore environments. Overall risks to drinking water would decrease as a result of less use of upland sites. However, the material that does require confined disposal would have high levels of chemicals and could result in an increase in site-specific impacts in ground water and freshwater quality. Though the actual risks and effects would be site specific, on balance, Site Condition III has the potential for lower adverse effects to human health than does Site Condition II.

Noise impacts at the open-water site would be about the same as with Site Condition II, but there would be measurably less noise effects at land and shore sites. Overall, the adverse effects to noise resulting from Site Condition III are considered to be less somewhat significant than those of Site Condition II.

d. Cumulative Effects. The location of the disposal site in Commencement Bay significantly contributes to the avoidance of direct and indirect adverse effects to important human and environmental resources. The increase in

chemical loading to the Sound that would result with Site Condition III relative to Site Condition II could have a greater cumulative effect on marine ecosystems, though this is not possible to quantify.

4.07 Selection of the Commencement Bay Alternative. Of the alternatives considered for the Commencement Bay area, including the No Action alternative, the selected alternative is alternative CB1-II: unconfined, open-water disposal site 1 and Site Condition II material. Several factors, discussed below, are significant in the preference for this alternative.

The two sites considered for Commencement Bay are nearly identical based on an analysis of impacts to physical, biological, and human environments. In fact, site boundaries between the two overlap. Both sites meet two key site identification factors: (1) the site should be located in relatively nondispersive environments, and (2) are positioned to minimize disturbance to key biological resources.

Site 1 was selected for several reasons. For one, site 2 is in a somewhat less depositional environment than is site 1. Although use of either site would be expected to result in similar impacts to biological resources, impacts at site 2 could be greater. Site 2 contains higher (though not significantly higher) biomass than site 1, although biological resources at both sites are considered low compared to nearby reference areas. Because of the higher biomass levels, site 2 is considered to have a slightly higher food resource value to bottom fish.

The selection of the biological effects condition for site management is based on consideration of the overall environmental effects of the dredged material disposal program (including aquatic and land/shore effects). In order to ensure consistency throughout the region, these assessments were made for the entire Phase I (central Puget Sound) area.

Dredged material discharged at the unconfined, open-water sites must be suitable for maintaining the chosen site management condition. Under Site Condition II, dredged material deposited at Commencement Bay site 1 is predicted not to have unacceptable adverse effects on biological resources at or around the disposal site or to human health. Impacts that do occur to aquatic organisms would be confined to the disposal site and would not exceed sublethal chemical effects to the few remaining and more sensitive species on site (i.e., significant acute toxicity will not be present on site). A monitoring program developed for the PSDDA disposal sites will be used to ensure that effects at the disposal site do not exceed Site Condition II limits and that offsite impacts are not occurring. If monitoring indicates that impacts are exceeding predictions, appropriate site management response would be taken.

Site Condition I has less potential for effects to the aquatic environment relative to Site Condition II, but would relatively increase the potential for adverse effects to land and shore environments. Site Condition III, on the other hand, would result in much greater effects to the aquatic environment than would either Site Condition I or Site Condition II with almost no impacts to land and shore environments.

Costs for testing, dredging, disposal and monitoring of the volume of sediment that is forecasted to require removal over the next 15 years in Commencement Bay and vicinity under Site Condition I would be approximately $48.3 million, almost $25 million over the costs of disposal under Site Condition II. Site Condition III would incur dredged material management costs of about $15 million, almost $8 million less than Condition II.

The selected alternative is consistent with Section 404 of the CWA which governs the discharge of dredged material in nearshore waters of the United States. Under Section 404(b)(1) no "unacceptable adverse effects" can result from the discharge of dredged material in open water sites. Research and analysis of data used to define the alternative site conditions indicate that disposal under Site Condition II would not result in unacceptable adverse effects on aquatic resources. The selected site management condition would, furthermore, not allow significant acute toxicity on site, thus meeting State water quality standards and the condition frequently used in the implementation of Section 404 nationwide.

In considering the overall effects (total impacts of dredged material disposal) to land and water, the use of Site Condition II is considered the environmentally preferred approach and was therefore chosen. Additionally, alternative CB1-II, site 1 and Site Condition II, most closely meets the stated PSDDA goal to provide publicly acceptable guidelines governing environmentally safe unconfined, open-water disposal of dredged material in Puget Sound.

ENVIRONMENTAL EFFECTS OF THE
ALTERNATIVES CONSIDERED FOR ELLIOTT BAY

4.08 Alternative EB1-II: Elliott Bay Site 1 with Site Condition II - Selected Alternative. The final EIS alternatives evaluated for the Elliott Bay area are shown in table 4.10.

a. Impacts and Their Significance to the Physical Environment.

(1) Water Quality.

(a) Marine Water. Disposal activities at the selected site would not significantly affect water quality conditons (i.e., currently Class A waters) in inner Elliott Bay, except in the immediate vicinity of the disposal site.

Some short-term water quality impacts within the disposal site are anticipated following disposal of acceptable dredged material from bottom dumped barges due to elevated levels of suspended solids within the dredged material plume. Water quality monitoring of an experimental disposal site in Elliott Bay during and after disposal operations for a period of 9 months showed no significant long-term impacts to water quality (Baumgartner et al., 1978; Schell et al., 1978; Pavlou et al., 1978). Transient impacts observed were some elevated levels of PCB (i.e., increases from 3 ng/l to as high as 3 ug/l), d-Mn, and NH_3-N, which were all associated with increased suspended solids levels and were short term (generally minutes) in duration. No important chemical changes in the water column were documented during disposal activities at the Columbia River ADFI site located off the mouth of the Columbia River, or at other sites throughout the country during the DMRP (Dredged Material Research Program) (Wright, 1978).

Through a suggested source of chemical contribution to the sea surface microlayer, dredged material chemical input to the microlayer has not been verified or quantified, but is not considered significant relative to other probable sources from permitted discharges (i.e., sewage effluent) (Word and Ebbesmeyer 1984, Word et al., 1986; Hardy and Cowan, 1986). Contributions to the sea surface microlayer will continue to occur from a variety of sources, including airborne sources (dry particulate fallout, precipitation, gases, and animal materials), land sources (including shoreline erosion, river runoff, discharge of sewage and industrial effluents, and spills from vessels and land based facilities), and nearshore sediments (through upwelling, bubbles, or biochemical transformations). Observations of shoreline contamination in Puget Sound strongly implicate sewage discharges and street runoff as primary causative agents (Word and Ebbesmeyer, 1984). Review of the literature on sea surface microlayer composition, sources, and impacts on phytoplankton and phytoneuston is presented in a PSDDA report prepared by Word, et al. (1986). To ensure that the dredged material disposal does not result in a release of unacceptable concentrations of chemicals to the water column, the PSDDA evaluation procedures call for water column testing, if warranted, on a case-by-case basis.

TABLE 4.10

FINAL EIS ALTERNATIVES EVALUATED FOR ELLIOTT BAY

EIS Alternative	Description	Addressed in EIS Section
EB1-II	Elliott Bay Site 1 and Site Condition II (selected alternative)	4.08
EB2-II	Elliott Bay Site 2 and Site Condition II	4.09
EB1-I	Elliott Bay Site 1 and Site Condition I	4.10
EB1-III	Elliott Bay Site 1 and Site Condition III	4.11
Selection of Elliott Bay alternative		4.12

In addition to the above impacts, suspended dredged material may become incorporated in the nepheloid layer that is found near the sediment/water interface. A quantitative estimate of the amount of disposed material that might become associated with the nepheloid layer is not possible; however, the level of contribution is not expected to be significant. Indirect evidence of dredged material contribution to the nepheloid layer were seen in research conducted during the Field Verification Program in Long Island Sound. Benthic species near the experimental disposal site exhibited increased levels of certain chemicals during disposal activities. Following disposal, however, tissue residue values dropped to background levels in organisms collected near the disposal site (FVP study, 1987). The PSDDA monitoring plan calls for collection of tissue residue data for benthic species collected off the disposal site to further evaluate any potential impacts to the nepheloid layer.

In conclusion, only transient and temporary changes in suspended solids levels and increased levels of sediment-bound chemicals are expected during disposal activities, with no significant adverse impacts to water quality anticipated.

(b) Freshwater and Ground Water. Impacts to freshwater and ground water quality can arise from two potential sources: (1) release of chemicals in effluent during dewatering or from uncontrolled runoff, and (2) release of chemicals via leachate from confined sites which could enter ground water. Impacts from effluent or uncontrolled runoff depend on the type of water (hard versus soft) and the existing water quality of the receiving

waters. The degree of chemical release associated with effluents can be controlled through a variety of technologies including construction of wiers and settling ponds.

Significant adverse impacts on ground water may result from the production of leachate containing chemicals of concern at the disposal site. Because of the geochemical changes that are associated with drying and oxidation, a large fraction of sediment chemicals can be mobilized. Impacts associated with leachate contamination would be greater under this alternative than all others considered. The magnitude of the impact of leachate production on ground water quality would depend on the chemical composition and physical characteristics of the dredged material, the characteristics of the interfacing soils, and the planned use of the underground receiving waters. The relative potential for freshwater and ground water chemical release under this alternative is less than the impacts that would be predicted if only Site Condition I had been chosen for the unconfined, open-water disposal sites and greater than the impact if Site Condition III had been chosen.

(2) Marine and Estuarine Sediments. The same general procedures used to delineate the Commencement Bay disposal site (DSS TA, 1987) were used for Elliott Bay as well (section 4.03.a(2)). The proposed Elliott Bay site is located at a depth of 200-300 feet and is subject to sluggish tidal currents; therefore, the dredged disposal model used a 400-foot depth and a 0.1-foot per second (0.06 knot) current to estimate the extent of the material deposition. The site is located in a submarine valley with relatively steep sides and a downward slope varying between 1-foot vertical on 30 feet horizontal to 1-foot vertical on 50 feet of horizontal distance. These bathymetic features probably would play a significant role in determining the size and shape of the disposal area. Consequently, the anticipated site would be a teardrop-shaped area having a width of approximately 4,000 feet and a length of approximately 6,000 feet (DSS TA, 1987). Assuming that an annual average of the volume that could be discharged at the selected site over the period 1985-2000[1/] is experienced beyond the year 2000, the estimated site capacity would be reached in year 2025.

The results of a monitoring effort by the Corps New England Division at their Portland, Maine, disposal site, indicate that the selection of the disposal site in a deep valley is an excellent choice, since the steep slopes on the margins contribute to containment of the material. In addition, in 1976, an extensive study undertaken at the experimental disposal site located within the inner Elliott Bay ZSF indicated that dredged material was not eroded over a several-year period. Finally, sediment cores taken in the bay indicate that natural sediments deposit at the rate of approximately 1 centimeter per year (Lavelle et al., 1986). Combined, these studies present strong evidence supporting the conclusion that, once material is deposited at the proposed disposal site, not only would it remain confined to the valley in which it is placed, but that after disposal operations cease, natural sedimentation would cover the disposed material at a relatively rapid rate.

1/See table 4.2b.

Surface sediments at Elliott Bay site 1 are primarily fine mud and clays (DSS TA, 1987) and the site appears to be one of net deposition. Material expected to be disposed at the open-water site would range in grain size from primarily silt and clays (Lower Duwamish River) to material that is primarily sand (Upper Duwamish River Turning Basin) (Tetra Tech, 1986). Although some changes in grain size distribution at the disposal site can be expected due to disposal of Elliott Bay area dredged material, these impacts are not expected to have a significant adverse impact on the sediments of the area.

Sediment chemistry analyses of samples from the area of site 1 indicate that the sediments have moderate levels of chemicals of concern, with concentrations similar to other sites in inner Elliott Bay. Disposal of dredged material allowable under Site Condition II would not increase sediment chemical levels within disposal site 1. For some chemicals, already elevated in onsite sediments, disposal would actually decrease the site chemical levels. See "Impacts and Their Significance to Biological Environment" for a discussion of the possible impacts to biological resources due to potential increases in sediment chemicals onsite.

(3) Air Quality. No significant loading of concern chemicals to the existing air environment are anticipated as a result of forecasted disposal activities at the preferred site in Elliott Bay. Tug boat towing of barges to the disposal site is expected during the normal 45 to 50 days of average annual site usage. During this usage, on the average about 2 to 4 barges per day would be discharging at the site with peak activity of 6 barges per day (table 4.9).

Some hydrocarbon releases, including hydrocarbon byproducts and particulates from diesel fumes would be released during tugboat towing of barges to the disposal site. Negligible concentrations of hydrogen sulfide gas may also be released from the dredged material during open-water disposal activities. In summary, no significant impacts are anticipated to the air quality environment in Elliott Bay as a result of disposal activities due to the selected alternative.

(4) Land. Habitat losses associated with dredged material that must be placed in other disposal sites (benthic/land/shore/confined) could include loss of wetlands, loss of fish feeding and rearing habitat, loss of land vegetation, and loss of natural shoreline areas (see sections 2.04 and 4.02 above). An estimate of habitat losses was developed for the Elliott Bay selected alternative (table 4.3), indicating that approximately 415 acres of benthic habitat would be covered by the preferred open-water disposal site, while land and shore losses would approximate 266 acres. It is not possible to further distinguish between upland and nearshore losses, since development of either would depend on relative site availability. The Elliott Bay area has experienced substantial shoreline filling and land development relative to other two Phase I major dredging areas. As a result, there are very few areas that could serve as potential disposal sites without the displacement of other

human land uses (i.e., industrial development) or significant losses of nearshore habitat. Since land and shoreline sites within the bay are expected to be difficult to come by in future years, land disposal may often need to occur at more distant sites (with long hauls for truck transport) and added pressure may exist for increased reliance on confined aquatic disposal.

The significance of these losses would depend on the ecological value and previous uses of the land prior to its use as a dredged material disposal site. The open water site used for unconfined disposal is expected to be recolonized following cessation of disposal activity (see Section 4.08.b(3)(a), Impact to Benthic Infaunal Resources). Land sites that are developed for human use (e.g., disposal sites), however, are usually permanently lost from ecological production unless extensive effort is put into reclamation. Development of nearshore areas could result in significant adverse losses of salmonid feeding habitat.

b. Impacts and Their Significance to the Biological Environment.

(1) Flora.

(a) Marine and Intertidal. Little impact to marine and intertidal species is expected under this alternative. Impacts that would occur to intertidal and subtidal macroalgae and eelgrass would primarily be due to the introduction of short-term pulses of suspended materials from effluent outfalls from nearshore or upland sites that could interfere with photosynthesis by reducing light availability. This impact would be expected to be minor and confined to the area around the outfall and can be reduced through proper control of effluent discharge. Relative impacts under this alternative would be less than those predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites and greater if Site Condition III had been chosen.

(b) Terrestrial. Significant adverse impacts to terrestrial plants can result with disposal of dredged material at confined upland sites. Site preparation requires complete destruction of the existing habitat including removal of vegetation and possibly excavation of top soil (which can be used to construct dikes, berms or stored for later use as a soil cap) (Canter et al., 1977). Under this alternative, approximately 266 acres of upland and nearshore area would be used to develop confined disposal sites. The impacts to plant communities under this alternative are greater than those associated with Site Condition III and less than the impacts associated with Site Condition I.

Following disposal, land sites may still present significant adverse impacts to plants recolonizing the area. High salt content and the presence of chemicals may hinder successful germination and growth of many plant species. In addition to slowing or preventing reestablishment of plant communities on site, vegetation around the perimeter of the disposal area may also be acutely impacted as a result of salt seepage (Harrison and Chisholm, 1974).

Once a disposal site is no longer in use, remedial action can be undertaken to rehabilitate the land, although this is often difficult to accomplish (Grosselink, 1973). Sites can be seeded with saline resistant plants or covered with enough top soil to act as an effective barrier between establishing plants and the dredged material. Additionally, dredged material can be deep plowed and limed to enhance soil conditioning prior to establishment of vegetation (CZRD, 1978).

(2) Plankton.

(a) Marine Phytoplankton. Impacts to phytoplankton would result during disposal operations from intermittent pulses of suspended material that could either promote and inhibit primary production. Turbid mixtures of organic and inorganic material both interfere with photosynthesis by shielding light and stimulate growth by raising inorganic nutrient levels above background levels. Impacts can also occur from suspended materials adhering to the surfaces of cells, interfering with gaseous/nutrient transport across the cell wall, possibly leading to mortalities. Also, phytoplankton in the path of the descending dredged material mass would be removed from the euphotic zone and lost (flocculated). The release of growth inhibitory substances from the dredged material may also occur. Concern chemicals released during disposal could result in inhibition of photosynthesis by interfering with metabolic pathways.

As disposal operations would not occur during the major portion of the spring bloom period when dredging is not permitted due to salmon and steelhead smolt outmigration. The high phytoplankton productivity at that time of the year would not be significantly impacted. Disposal would occur, however, during the fall bloom period, so that impacts to the phytoplankton community may be somewhat more pronounced than during other times of the year. The overall impacts on primary production would be localized, are likely not measurable, and are not expected to be significant.

(b) Zooplankton. Impacts to zooplankton could result from suspended particles interfering physically with active feeding. In addition, suspended particle loads would dilute the concentration of food particles in the water for filter feeders and, in some instances, reduce the amount of available food (due to flocculation of phytoplankton).

Zooplankton in the immediate disposal area could become entrained by the disposal material with resultant mortalities. However, most zooplankton are spatially distributed over a wide area in the water column and any impacts at the disposal site would not be expected to significantly affect Elliott Bay zooplankton community structure.

Any impacts to the Elliott Bay zooplankton community would be localized and short term. Chemicals released from the disposal operation may have measurable, although short term, and localized impacts. Localized impacts could include mortality, inhibition of growth and reproduction. However, the temporal nature of the disposal and the small percentage of zooplankton impacted relative to the existing bay-wide community, would render this impact insignificant.

(3) Invertebrates.

(a) Benthic Infaunal Resources. Two types of impacts would occur as a result of dredged material disposal at the selected PSDDA open-water site: (1) physical impacts, and (2) chemical impacts. Each is discussed in turn with respect to probable impacts to the sedentary benthic infaunal resources existing within the disposal site and immediately adjacent to it.

Anticipated physical impacts to sedentary benthic infaunal resources resulting from dredged material disposal in the selected site would include the immediate, but temporary, loss of benthos due to burial and smothering by clumps of cohesive material within the relatively small single dump bottom impact area ("250-foot diameter," see section 2.03h(1)) of the overall disposal site. Direct physical impacts from dredged material hitting the bottom would be greatest in the center of the impact zone and diminishing to negligible impacts toward the edges of this zone. It is likely that some of the buried infauna would be able to survive initial burial by vertically migrating out of deposited material, particularly if they are covered by less than 20 cm of material. Several benthic infaunal species have demonstrated the ability to migrate vertically and survive burial induced by relatively thick covers (i.e., up to 50 cm) of sediments with particle size distributions both similar to, and different from, their preferred sediment habitat (Maurer, et al., 1978).

During periods of dredging inactivity, partial recovery of benthos due to recruitment and migration from surrounding unimpacted areas can be expected. Likely recruits to the disposal site may consist of polychaete opportunists such as *Capitella capitata*, *Spiophanes fimbriata*, and *Boccardia polybranchia* (Battelle Draft Report to EPA: Detailed Chemical and Biological Analysis of Selected Sediments From Puget Sound, 1985) as well as from resident bivalve species, such as *Axinopsida sericata*, and *Macoma carlottensis*. Recolonization may result in the partial restoration and/or possible enhancement of benthic habitat values to foraging bottom fishes (Rhoads et al., 1978; Becker 1984). Tatum (1984) reported an increase in benthic species abundance at an experimental disposal site in Elliott Bay following disposal operations. Additionally, a recent BRAT survey of the Foul Area disposal site off the coast of New England showed that benthic resource food values on site were increased as a result of disposal activities relative to offsite conditions for many of the target flatfish foraging strategies examined, particularly fish foraging for smaller prey living near the sediment-water interface (Lunz, 1986).

Existing benthic communities found onsite are adapted to fine-textured, medium silt/coarse silt bottoms. Potential changes in bottom sediment grain size distribution resulting from dredged material disposal would likely have a detrimental impact on many of the resident infaunal species (i.e., due to lower reproductive potential, impaired recruitment success, and survival of young) as well as negatively influencing the ability of buried adults to vertically migrate and survive burial (Maurer, et al., 1978).

Under the effects definition for Site Condition II (see section 2), some sublethal impacts to onsite benthos are possible from chronic exposure to dredged material. These impacts would be confined to the disposal site. The PSDDA monitoring program includes a check of benthic community health around the disposal site to ensure that unacceptable biological impacts are not occurring. The severity and extent of biological effects from the dredged material are not expected to be significant since the majority of the taxa found at the selected site (polychaetes, bivalves; Clarke, 1986) are not known to be acutely sensitive to chemicals of concern. Effects associated with Site Condition II would include sublethal impacts, with potential increases in the mortalities of the more sensitive, but less abundant, crustacean species (section 3.02b(1)(b)).

Cumulative effects of exposure to the dredged material expected could result in a reduction in population and community biomass of equilibrium (Stage III) species, with a corresponding increase in abundances and biomass of more pollution and disturbance tolerant pioneering (Stage I) species. This pattern would also be maintained by the periodic physical disturbance of the site during diposal operations. Tissue concentrations of contaminants may also increase in onsite benthos exposed to the dredged material.

Impacts that occur off of the site would not be significant, consisting of food web impacts and possibly sea surface microlayer impacts. The former involves mobile benthos (crab, shrimp, etc.) feeding on disposal site benthos and migrating offsite with a chemical body burden and, perhaps, chronic effects, and contributing chemicals via predation or decomposition to the bay food web. The degree of food web transfer is unknown, but should not be significant, due to the nature of the site management condition. Nearshore, intertidal and subtidal invertebrate fauna would not be significantly impacted from the disposal operations due primarily to their distance from the disposal site. Existing sea surface microlayer chemicals may occasionally contact the nearshore benthos as a result of currents, tidal actions, and wind moving chemicals onshore. In the case of Elliott Bay site 1, the probability that contaminants from the disposal material would significantly contribute to the existing sea surface chemical load, with significantly increased impacts, is considered low. (Word and Ebbesmeyer, 1985; Word et al., 1986; Hardy, 1986).

(b) Intertidal. Intertidal invertebrates would be impacted by any development of the nearshore environment for use as confined disposal sites. Physical impacts to sedentary species from dredged material disposal would be the immediate loss of intertidal communities due to burial during disposal activity. Effects observed at the nearshore site are expected to be sublethal in nature if material disposed in the nearshore environment contains chemicals in concentrations characterized as Site Condition II. Some acute impacts could be expected if dredged material exceeds Site Condition II. Species impacted would include copepods and gammarid amphipods, which can comprise 30 to 40 percent (by abundance) of the species present in intertidal communities. Chemical impacts are expected to be localized to the area immediate to the effluent outfall. Overall impact to intertidal communities would be dependent on both the amount of nearshore area taken for disposal site use and the level of chemicals in the material disposed.

(c) Mobile Crab and Shrimp Resources. Various shrimp species would be impacted by disposal at the selected site. The primary impact would occur during the fall season, as moderate densities (up to 885 shrimp per hectare) have been observed from the eastern half of the site. The impact during the winter (primary dredging period) or summer would be much reduced. Fall densities could conceivably support a limited commercial or recreational shrimp fishery, were they not located in a very high boat activity and harbor area in inner Elliott Bay.

Using a conservative analysis, shrimp could suffer mortalities in the immediate impact zone from clumps of disposal material. These clumps could bury shrimp to a depth through which they could not vertically migrate. Mortalities from clumped material encounters would be minimal outside the immediate center of the drop impact zone, and due to minimal projected daily depths of dredged material expected (see section 2.03h(1)). Deposition of material in the impact zone extending out to the aprons of the disposal impact area would be light, and would not impact the shrimps ability to maintain contact with the sediment surface. However, some mortality due to suspended material clogging gill filaments are possible. Most shrimp may migrate offsite in an effort to escape respiratory distress induced by elevated suspended solids. In time, shrimp would migrate into the disposal area, possibly attracted to food organisms and, if they remain (i.e., colonize the site) could suffer mortalities during subsesquent disposals.

Possible other impacts onsite could involve shrimp exposure to sediment chemicals contaminants and possible bioaccumulation, leading potentially to sublethal impacts to shrimp remaining on the disposal site. Shrimp may also migrate offsite, so that the chemicals could enter the food web via predation. Due to existing high sediment chemical levels in the vicinity of the preferred site (Tatum, 1984), no commercial fishery exists for shrimp in Elliott Bay. It is likely that bioaccumulation of chemicals such as PCB may reduce the marketability of shrimp in Elliott Bay, and thus the commercial value of shrimp caught in inner Elliott Bay would probably be negligible under existing conditions.

(4) Fish.

(a) Anadromous Fish. Impacts of disposal operations on important juvenile salmon populations would be negligible, primarily because no disposal operations would occur between April 1 and June 15, the "window" designated by the Washington State Department of Fisheries to protect juvenile salmon during downstream migration. The majority of the juvenile salmon populations will have migrated out of Elliott Bay by June 15.

Disposal would occasionally be coincidental with the presence of early or late migrants (especially chinook salmon) or with those species that may tend to remain in the bay for extended periods of time (e.g., searun cutthroat trout). These juveniles would not be impacted by the disposal operations unless they frequented the disposal area where they could pass through the turbidity plume and be subject to turbidity impacts, which include interference with oxygen exchange due to suspended solids clogging gill surfaces, and

slightly lowered oxygen availability due to biological oxygen demand of the suspended dredged material that forms the disposal plume. Impacts to juveniles due to exposure to chemicals in the plume would probably be negligible as most chemicals would be unavailable, bound to the sediment particles rather than dissolved in the water column where they could be absorbed across gill surfaces. These impacts, if they occurred at all, would be minor since juveniles typically avoid disposal plumes.

Adult salmon and trout migrating through the bay would also not be significantly impacted by disposal operations as the majority of the fish would avoid disposal-associated turbidity plumes. Those fish that contact the plume, however, would be temporarily impacted from short-term clogging of their gills by suspended material, and from slight depressions in dissolved oxygen due to the biological oxygen demand of the dredged material. However, these conditions are far less severe than the fish usually encounter when they migrate up the Green-Duwamish River during periods of floods or highwater.

Contribution of chemicals to the sea surface microlayer from Site Condition II dredged materials may occur, but is expected to be minor relative to existing levels of chemicals from other sources (Word et al., 1986; Hardy, 1986). Actual chemicals and their concentrations would be difficult to identify/measure in view of many source contributions in Elliott Bay. Adult salmon may occasionally swim at the surface for short periods and therefore contact the microlayer during their milling behavior, however, physiological effects due to dredged material chemicals would not be expected to occur. For there to be a noticeable impact on adult salmon fished in the bay, the salmon would have to swim for extended periods of time at the surface and near to the disposal area or microlayer "plume" to absorb chemicals via the gills, possibly resulting in minor physiological impairments. Swimming at the surface for extended periods is not typical of migrating adult salmonids. In general, disposal operations involving material suitable for Site Condition II should not significantly impact physiological mechanisms/behavior patterns of adult salmon in Elliott Bay.

(b) Bottom Fish Resources. Negligible bottom fish resources were found on or near the selected site during site specific studies in February, June, and September 1986 (section 3.02(b)(2c)). It is therefore probable that the area in Elliott Bay, occupied by the selected site, does not represent prime bottom fish habitat. Nevertheless, some direct and secondary impacts to bottom fishes are expected to occur as a result of disposal of Site Condition II dredged material at this site. Clumps of cohesive material impacting the bottom may bury flatfish such as Dover sole within the "250-foot" diameter bottom impact zone (see section 2.03h(1)). Any fish found outside the bottom impact zone would likely escape direct impacts, but may suffer some respiratory distress due to gill clogging and/or low dissolved oxygen levels (i.e., due to high COD/BOD levels), induced by elevated levels of suspended solids within the dredged material plume. It is highly likely that fish would avoid stressful levels of suspended dredged material by temporarily moving out of the area. In conclusion, because only low numbers of bottom fish resources were found on site, direct physical impacts from disposal on these resources are not expected to be significant.

Bottom fish resources may also be affected through secondary impacts resulting from disposal of dredged material in the preferred disposal site. Benthic habitat within the "250-foot" impact zone is expected to be temporarily lost as a result of burial and smothering, further lowering the value of the area as food habitat for bottom fish. As this area does not appear to be a prime feeding habitat area for bottomfish in general (Clarke, 1986), the impact of this habitat loss to fish resources is not expected to be significant.

Benthic resources, however, are expected to recover during periods of disposal inactivity. Fish food habitat values might even increase as a result of increased production of pioneering (stage I) opportunistic species on the disposal mound (Rhoads et al., 1978; Becker, 1984). Bottom fish foraging on these opportunistic species may bioaccumulate chemicals through dietary intake of prey. Direct accumulation of chemicals might also occur through skin and gill membranes as a result of their intimate association with the bottom sediments, particularly when buried in the sediments. Because the area of the disposal site only represents a relatively small portion of the foraging habitat for demersal bottom feeding fish in Elliott Bay, and documented fish food habitat resources on site are uniformly low, only very low levels of chemical bioaccumulation in fish predators are possible.

(c) Freshwater Fishes. For disposal of material unsuitable for unconfined, open-water disposal, impacts to freshwater fish can result from the introduction of effluent discharge into freshwater habitats. Two sources of impacts are associated with effluent discharge: (1) impacts due to increases in turbidity and siltation, and (2) impacts due to increases in chemicals.

Fish species in general, and freshwater game fish in particular, have a low tolerance for increases in turbidity (Canter et al., 1977). Fish mortality due to asphyxiation is often the result of the coating effect of fine particles settling on the gill filaments (Sherk and O'Connor, 1975). Eventual reduction in fish population size and even local species elimination have been found as a result of increasing turbidity levels in streams that typically had low background levels of suspended solids (Hollis et al., 1964).

Another possible impact due to turbidity and siltation on fish populations is through the reduction in spawning ground habitat (Hollis et al., 1964). Ripe running fish will abandon previously used spawning grounds if siltation is too great. Siltation will result in suffocation of fertilized eggs by reducing oxygen exchange across the egg surface.

Freshwater fish are generally more sensitive to chemicals of concern than are marine species and are therefore more susceptible to chemicals associated with effluent runoff from confined disposal sites. In addition, toxic metals are more readily available to organisms in freshwater than in saline waters, in effect increasing the exposure environment. The relative potential for impacts to freshwater fish under this alternative is less than the impacts that would be predicted if only Site Condition I were chosen for unconfined, open-water disposal sites and greater than the impact if Site Condition III were chosen.

(5) Terrestrial Wildlife. Development of upland and nearshore confined disposal sites would require the destruction of wildlife habitat and cause significant adverse impacts to terrestrial wildlife. The types of wildlife and number of species impacted by site construction would depend on the specific type of habitat being destroyed. Disposal site construction on a field would impact generally smaller-sized animals and relatively less diverse communities than would be expected if forested land were utilized as sites for confined disposal. The significance of the impact to terrestrial species will depend upon the availability of nearby habitat (and its carrying capac- ity) to assimilate displaced wildlife. Relative impacts under this alterna- tive will be less than those predicted if Site Condition I were chosen for the unconfined, open-water disposal site and greater than impacts if Site Condition III were chosen.

(6) Birds.

(a) Water Birds. The only direct impacts of open-water disposal on waterbirds would appear to be the result of temporary turbidity, temporary loss of prey source, and potential impacts to intertidal organisms from drift of suspended dredged material. Turbidity limits visibility and makes feeding difficult, if not impossible. Turbidity from disposal activity, however, is localized and temporary; furthermore, waterbirds will avoid the turbidity plume and feed elsewhere. Benthic resources at the disposal site are generally not utilized as food by waterbirds. Few birds dive greater than 120 feet (cormorants and loons may), which limits the impacts to a few species. Furthermore, stomach samples of deep-diving birds indicate that bottomfish comprise only a small proportion of the total diet. Thus, these birds do not depend on bottom-living organisms,and, in fact, primarily utilize free-swimming fish such as herring and smelt.

Even if the disposal areas were utilized by waterbirds and the sites did not fully recolonize, the total area of impact is small relative to the potential feeding area in Puget Sound. Waterbirds are mobile; also, the preferred site selected has relatively low biological productivity to begin with, such that the loss would be minimal. The potential loss of intertidal organisms from drift of suspended material is considered to be minimal and would not affect waterbirds.

The selected disposal site is not presently nor historically an area of concentration of waterbirds. Elliott Bay's primary value to waterbirds is in the protected intertidal areas, where most of the waterbird species can find refuge and a food resource. Significant impacts could be expected to shorebirds if nearshore areas were developed as confined disposal sites.

(b) Terrestrial Birds. For material requiring confined disposal, terrestrial birds could be significantly impacted under tne preferred alternative depending on the types of upland habitat used for construction of confined disposal sites. Impacts would be greater if forrested land were used relative to cleared land because of the greater diversity of birds associated

with the former. Following reclamation of the area after the life of the disposal site, sublethal chronic impacts to terrestrial birds could occur due to ingestion of plants and animals that have accumulated chemicals arising from the dredged material.

(7) Marine Mammals. No significant long-term impacts to marine mammals indigeneous to or migrating through Elliott Bay are expected from disposal of dredged material at the selected site. No marine mammals discussed in section 3.02(b)(4) are abundant in Elliott Bay, and their presence in the selected disposal site would only be a rare occurence. It is therefore probable that no significant physical or chemical impacts to marine mammals are expected. Those mammals in the vicinity of the disposal site during a disposal operation, would likely avoid the area during the dumping activity. Marine mammals feeding on bottom fish and macroinvertebrates in the vicinity of the disposal site may accumulate small levels of chemicals concentrated in their prey, although the amount attributable to the disposal site itself would probably not be significant due to their wide ranging foraging habits and the small percentage of site use (Wright, 1978).

(8) Endangered and Threatened Species. Biological assessments have been prepared that evaluate potential impacts to bald eagles, gray whales, and humpback whales (exhibit A). The only species on the Federal list that are found in Puget Sound are the gray whale, humpback whale, peregrine falcon, and bald eagle. Gray whales are regularly, though infrequently, sighted in Puget Sound. These are considered stragglers which may or may not feed while in Puget Sound. Some of the few recent sightings of gray whales in Puget Sound have been relatively close to the preferred disposal site. In each case, the whales were present for no more than 1 day and were not seen again in the same area. The implication is that the whales are "passing through" (and in all likelihood not feeding) and find no special attraction for any one area. It thus appears that selection of the proposed disposal areas would not impact gray whales, regardless of the sites ultimately selected. Much the same arguments can be made for humpback whales.

Peregrine falcons are rarely observed in the vicinity of any of the selected disposal areas; rarely enough, in fact, that the U.S. Fish and Wildlife Service did not include this species on its list of species that should be considered in the biological assessment. Their prey base consists of small waterbirds, primarily ducks such as teal, and shorebirds. Peregrines prefer to stoop on large flocks of such birds, where they have greater odds of finding one that is weak or confused and, hence, easy prey. Such flocks are most often in protected bays in intertidal or shallow subtidal habitats. The openwater disposal sites are relatively unprotected and generally do not attract large numbers of waterbirds. The lack of such large flocks at the proposed disposal areas sites that selection of the area would not impact peregrines (since their prey base would not be affected).

Bald eagles are present throughout the year near the selected disposal site. They feed on whatever may be present (ducks, gulls, live surface-swimming fish, dead animals washed ashore, etc.). Again, concentrations of birds or

fish are helpful for prey-capture success. The selected disposal sites for Elliott Bay does not have large concentrations of animals and thus feeding by bald eagles would not be affected.

Other potential affects associated with the disposal site include primarily human disturbance and noise from disposal barges. The most important consideration is that the selected site is not near regular areas of animal use. Thus, human disturbance and noise are not expected to affect any endangered species.

c. Impacts and Their Significance to Human Environment.

(1) Social Economic. Adverse impacts to waterborne commerce movements in Elliott Bay and vicinity, and related port terminal and industrial development are expected to be substantially less with this alternative relative to the No Action alternative. Because of higher costs associated with dredging and dredged material disposal, dredging cycles may be extended over that experienced in the past. However, delays would be less under this alternative than those expected if Site Condition I were chosen for management of the unconfined, open-water disposal sites. The Dredging and Disposal Activity section (see below) presents a comparative analysis of the costs associated with dredging under the alternatives considered by PSDDA.

Impacts to sport fishing could also occur due to displacement by tugs and barges at the disposal site (see Navigation section below). In addition, impacts to land and beach use could also be expected if nearshore and upland disposal sites were developed in recreational areas. Overall, social economic impacts are not expected to be significant.

(2) Transportation.

(a) Navigation. Normal average annual dredged material disposal activity in Elliott Bay is expected to be about 45 to 50 days per year, about the same or a little less than the level experienced over the past 15 years. Disposal activity could be considerably greater than this level for several years if the Duwamish Navigation Improvement project is undertaken. Actual activity would depend on dredging projects undertaken, and the results of chemical and biological tests performed on material to be dredged. As navigation channels would be maintained, there would be no adverse impacts on navigation activity due to channel shoaling. Barge-tug movement during disposal operations is not expected to be much different than at present and consequently there should be no significant navigation conflicts with commercial or pleasure craft.

Since disposal typically is accompanied by dredging, the Elliott Bay selected site would not be used during the salmon and steelhead smolt outmigration: April 1 through June 15. During times of normal site use, disposal activity at the site would be expected to average about two to four barges per day with peak activity of 10 barges per day (table 4.9).

when proceeding to the disposal site, tug and barge combinations move at a slower rate loaded than unloaded. Average travel speed is typically around 5 knots. Once on site, disposal operations within the 1,800-foot diameter disposal zone usually require between 5 and 10 minutes. On occasion, weather constraints and repositioning requirements (to ensure proper location of disposal) can increase the onsite time to as much as 20 minutes. Using an average of 10 minutes, and assuming three to four barges per day, normal site occupancy could amount to about 30 to 40 minutes per day or about 25 hours per year.

Though delays in disposal activities could result from avoiding conflicts with tribal fisheries (see below), they are unlikely, given the anticipated and required coordination between dredgers and the tribes.

Disposal operations at the selected site would represent a slight increase in navigation traffic for the site proper. With increased water traffic, there is an increase in risk of minor oil leaks or spills, and of vessel collisions. The infrequent site use, and the short duration of site occupancy, combined with the use of the Coast Guard's vessel traffic system, indicate that these risks are likely not significant.

(b) Land. Impacts to land transportation would be similar, though less than those resulting from the No Action alternative, as about 32 percent of future dredged material is expected to be found allowable to be placed in the Elliott Bay disposal site. Truck hauls and traffic congestion associated with upland disposal would be less than under the No Action alternative where most dredged material would be placed in nearshore or upland sites.

(3) Dredging and Disposal Activity. The overall impact of this alternative on dredging activity in Elliott Bay would be to increase the volume of material found acceptable for unconfined, open-water disposal over that allowable under existing interim criteria. Until June 7, 1987 the acceptability of material for open-water disposal in Elliott Bay was based on the Fourmile Rock Interim Criteria. That site has now closed with the expiration of the shoreline permit. However, the State and local governments have indicated that, absent action by PSDDA, these criteria would be replaced with PSIC. Using PSIC, only about 13 percent of the future Elliott Bay area material is expected to be acceptable for unconfined, open-water disposal. Under the selected site management condition, 3.4 million c.y. of material is projected over the next 15 years to be found acceptable for unconfined, open-water disposal at the selected Elliott Bay disposal site (table 4.2b). Actual disposal will depend upon the outcome of chemical and biological tests conducted on the material and the actual projects proposed for dredging. Costs of dredging (includes testing, dredging, compliance inspections, and open-water site monitoring costs) over the next 15 years in Elliott Bay using Site Condition II would be approximately $162 million (table 4.6). Assumptions and detailed calculations used in deriving these estimates are described in the EPTA (part II, section 10). It is anticipated that as source control improves and project-specific experience and data become available, the portion of future dredged material that is acceptable for unconfined, open-water disposal would increase.

(4) Native American Fishing. The selected alternative is not expected to significantly impact Native American fishing in inner Elliott Bay. As described in section 2, steps have been outlined to ensure that disposal-related vessel traffic would be compatible with tribal fishing.

Disposal operations are not expected to affect salmonids in Elliott Bay. The disposal site is situated in water greater than 200 feet deep and salmonids feed at shallower depths. Adult salmon and steelhead trout migrating through the disposal site should not be impacted by disposal operations as the majority of the fish would avoid disposal-related turbidity plumes. The few fish that may pass through the plume may be stressed to a minor degree. However, this disturbance would be short duration and would not have any long-term effect on the health of the fish. The sea surface microlayer is also not expected to significantly impact salmonids or to have an effect on fishing gear. Contributions of dredged material to the sea surface microlayer have not been quantified, but are not considered significant relative to other probable sources from permitted discharges. Adult salmon may occasionally swim at the surface for short periods (during milling behaviour), but contact with sea surface microlayer chemicals would not affect the physiological health on marketability of the fish. The microlayer is not thought to be continuous on the sea surface, and appears to be easily disrupted; therefore, chemical problems with fishing gear and nets contacting the sea surface microlayer near the disposal site would not be significant.

Possible tribal concerns regarding the impact of the PSDDA proposal to water quality and fisheries resources upon which the tribal activities are dependent are addressed earlier in section 4 of the DEIS.

(5) Non-Indian Commercial and Recreational Fishing. Non-Indian fishing activities may be displaced during the discharge of dredged material at the selected disposal site. At times of major dredging activity, this displacement could persist for 5 to 10 minutes, 10 times per day. The selected disposal site has been located to minimize potential conflicts with known commercial and sports fishing activities. It is anticipated that displacements are more probable for sports fishermen than for commercial activities. The disposal site location and the relatively short duration of site use, are expected to preclude any significant adverse effects to fishing activities and catch success in these waters.

(6) Human Health.

(a) Via Seafood Consumption. No impact on human health is anticipated from the consumption of seafood that might be in or near the disposal site. Only suitable dredged material will be allowed for disposal at the site. No significant impact to human health is expected with Site Condition II.

(b) Via Drinking Water. When marine/brackish, dredged material is placed in a confined nearshore or upland disposal facility, the potential exists to generate leachates having adverse impacts on ground water and surface water used for drinking. Under this alternative, material forecasted

to be found unsuitable for unconfined, open-water disposal will have to be placed in a confined site. If the material is placed in a nearshore or upland facility, then potential for drinking water chemical impacts exists, especially if design features such as leachate collection systems, effluent control, or runoff control are not used or fail. Development of any upland or nearshore disposal sites, and the types of material allowed in these sites, would be subject to State and Federal regulations designed to protect drinking water sources. The relative potential for ground water chemical impacts under this alternative is less than the impacts that would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites and greater than the impacts if Site Condition III had been chosen.

(c) Via Inhalation of Dust. Dredged material placed on nearshore and upland disposal sites provides a potential source of dust with chemicals of concern that could have an impact on workers and residents living around such a site. Dust production can especially be of concern at multiuser sites where the deposited dredged material is being reworked. This can also be the case at a disposal site that is being prepared for alternate uses. The impacts to human health from inhalation of dust can be minimized by the application of suitable ground cover. The relative potential for dust production under this alternative is less than would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites, and is greater than if Site Condition III had been chosen.

(d) Via Direct Exposure. Little direct exposure of humans to contaminated dredged material occurs. The only segment of the population that might be expected to come into direct contact with dredged material are workers on dredging crews and at upland and nearshore disposal facilities. Material that is highly contaminated could be placed in secure disposal sites where protection against exposure to chemicals would be minimized by operational procedures (i.e., wearing protective clothing and respirator, security to limit access to the site, application of coverage soil for disposal).

(7) Noise. There have been no measurements of ambient noise levels or of the actual noise at the shore which would be produced by disposal equipment operating at the preferred disposal site in Elliott Bay. However, noise studies have been done at the shore adjacent to the Fourmile Rock disposal site in Elliott Bay that provide some estimation of the noise impact of disposal operations.

Between 20 September 1985 and 24 June 1986, eight separate noise studies were conducted in the residential area near the Fourmile Rock site by two noise consultants. Ambient noise measured between 35 and 70 dBA and averaged from 35 to 51 dBA during the different measuring periods. Noise from tugs and tug-barge combinations was measured at between 37 and 46 dBA. The average noise levels were in the low 40's. The exception was one barge which measured 58 dBA for a short time. Muffling has since been added to bring the noise level down further. In a number of cases, the noise testers reported that the tugs and barges could not be heard above ambient noise at the shore.

The selected Elliott Bay site will be at least 2,500 feet from the Seattle shoreline. It is assumed that noise impacts from use of the site will be well within State and Federal noise standards and, in many cases, unnoticeable.

(8) Esthetics. Disposal operations are not expected to significantly affect the esthetic quality or experience in Elliott Bay and vicinity. The disposal operations will be only a minor part of the marine activities ongoing in a busy harbor/marine transport area. Viewers from the various shoreline areas identified in section 3 will see the occasional presence (between one and 10 times daily during dredging operations) of a tug and barge moving into the inner bay area, spending about 5 to 10 minutes for disposal, and leaving the area. The tug and barge will be most noticeable from the Seattle waterfront, from high-rise office buildings, and from the West Seattle shoreline and bluff residential areas. The operations will not be particularly noticeable from the remaining view areas identified in chapter 3, such as from Magnolia Bluff residences. Viewers closest to the operation may occasionally observe a localized turbidity plume in the vicinity of the barge immediately following disposal. This plume will be short term and may be masked at times by Duwamish River runoff during high flow periods. Some viewers may perceive the tug and barge activity in a positive sense, in that it is an integral part of normal marine activities in Elliott Bay and does not detract from the overall view experience.

(9) Historic Impacts. As part of the disposal site identification mapping studies, a literature search was undertaken to establish if any historically significant shipwrecks were located within the Elliott Bay selected or alternative disposal sites. None were identified (DSSTA). However, in March 1988, additional literature review and sidescan sonar studies were made of the selected disposal site and shipwrecks were found there. Further studies are underway to mitigate for potential adverse impacts in close coordination with the State of Washington Office of Archaeology and Historic Preservation (see FEIS exhibits C and D).

d. Cumulative Impacts. In Elliott Bay, utilization of the selected disposal site would ultimately result in an overall reduction of cumulative impacts to deepwater benthic resources. Disposal would no longer occur in the deeper, higher energy "transition zone" environment of the DNR Fourmile Rock site so that overall dispersion and consequent exposure of organisms to dredged material chemicals will be reduced. Establishment of a climax benthic community at Fourmile Rock may take longer than for the existing Port Gardner DNR site due to a higher concentration of chemicals; however, the site is presently utilized by shrimp and bottom fish, and there is no reason to believe that full benthic community establishment would be significantly delayed. The existing sediment at the selected site would be gradually covered by dredged materials, considered to have, on balance, lower chemical levels than the existing sediments in inner Elliott Bay. Shrimp populations would in general, experience a less chemically impacted habitat. Overall, disposal at the selected low erosional site may, in concert with the expected improvement at the DNR Fourmile Rock site, result in a cumulative improvement of deepwater benthic habitat in Elliott Bay.

e. Relationship to Existing Plans, Policies, and Controls.

(1) Clean Water Act, Sections 404/401. Procedures used in identifying the selected Elliott Bay disposal site and site management condition are consistent with the 404(b)(1) Guidelines for Specification of Discharge Sites for Dredged or Fill Material (40 CFR Part 230). Federal advance identification of the selected site as suitable for disposal of dredged material pursuant to part 230.80 of the Guidelines is addressed in exhibit B. The selected site and site management condition are also consistent with Ecology guidelines for State water quality certification pursuant to Section 401 of the CWA.

(2) Coastal Zone Management. The Coastal Zone Management Act (CZMA) (Public Law 91-583: 86 Stat. 1280) was passed by the United States Congress in 1972. In June 1976, the State of Washington Coastal Zone Management Program (CZMP) was approved to receive funding allowing the CZMA to be implemented via the State Shoreline Managment Act (SMA) of 1971. As passed by the State legislature, the SMA provides "for the management of Washington's shorelines by planning and fostering all reasonable and appropriate uses." The SMA is implemented through detailed planning efforts that culminated in the Shoreline Master Programs (SMP) for the large municipalities and counties of the State. The selected alternative is consistent with the SMA and the current State CZMP, satisfying consistency with State and Federal coastal zone management requirements.

(3) City of Seattle Master Program. The selected disposal site is located within the jurisdiction of the city of Seattle, which adopted its shoreline master program in 1986. The site lies within the shoreline environment classified as conservancy navigation. Designation of unconfined, open-water disposal is a principal and accessory conditional use in this classification. Dredged material disposal at currently designated and permitted sites is a principal use permitted outright.

(4) Department of Natural Resources (DNR) Policy on Open-Water Disposal of Dredged Material into Puget Sound. Sites throughout the Puget Sound area have been designated by DNR for open-water disposal. If the dredged material cannot be beneficially utilized (e.g., creation of artificial islands, landfill), and it is approved by all of the various regulatory agencies for open-water disposal, it can be deposited in one of the DNR sites. Fees and leases from DNR and permits from other agencies are all required before disposal of dredged material can occur. The selected Elliott Bay site will be an approved DNR open-water disposal site once the local shoreline permit has been granted by the city of Seattle.

(5) Executive Order 11990, Protection of Wetlands. The intent of Executive Order 11990 is to protect wetlands because of the significant cumulative losses that have occurred, and due to their high value to biological productivity and their many other critical functions. As the selected Elliott Bay site lies in water over 200 feet deep, no wetlands would be directly affected. Dredging projects which could affect wetlands would be evaluated on a project by project basis at the time the project is reviewed for permits under Section 404 of the CWA.

(6) Executive Order 11988, Flood Plain Management. The intent of Executive Order 11988 is to provide guidance and regulation for projects located in, and affecting, the flood plain. Executive Order 11988 requires, to the extent possible, avoidance of long- and short-term adverse impacts associated with occupancy and modification of flood plains.

As the selected open-water disposal site lies in water over 200 feet deep, no direct flood plain impacts would be involved by use of this site. Dredging projects which could affect the flood plain would be evaluated on a project by project basis at the time the projects are reviewed for permits under Section 404 of the CWA.

(7) Puget Sound Water Quality Comprehensive Plan. The Puget Sound Water Quality Comprehensive Plan was adopted 17 December 1986. The contaminated sediment and dredging program of the plan contains a sediment program goal "to reduce and ultimately eliminate adverse effects on biological resources and humans from sediment contamination throughout the Sound by reducing or eliminating discharges of toxic contaminants and by capping, treating, or removing contaminated sediments." The plan also adopts the following policies which shall be followed by all State and local agencies in actions affecting sediment quality, including rulemaking, setting priorities for funding and actions, and developing permit programs:

> "All government actions will lead toward eliminating the presence of sediments in the Puget Sound basin that cause observable adverse effects to biological resources or pose a serious health risk to humans."
>
> "Programs for management of dredging and disposal of sediments should result in a net reduction in the exposure of organisms to adverse effects. (The intent of this policy is that dredging and disposal contribute to the cleanup of the Sound by allowing unconfined, open-water sites to have only low levels of contamination and to dispose of more contaminated sediments in a manner that prevents continued exposure of organisms to adverse effects. For proposals where dredging will expose contaminated sediments, project-specific mitigation measures may be required."
>
> "Remedial programs (which may include capping inplace) shall be undertaken when feasible to reduce, with the intent of eliminating, the exposure of aquatic organisms to sediments having adverse effects."

The selected site is located to minimize the exposure of aquatic animals to dredged material placed at the unconfined site. The site is relatively non-dispersive and situated away from high abundances of important aquatic species and from human use areas of the sound. Although the species potentially exposed to the dredged material at the disposal site is different from those

present at the dredging site, the net effect of the dredging and disposal action could be to reduce overall exposure potential by moving the material from shallow estuarine areas to deeper marine waters.

Per the definition of the selected site management condition, the material to be discharged at the unconfined, open-water sites is not expected to pose a serious risk to human health. Though the selected condition could potentially result in some "observable adverse effect" in the form of sublethal effects to any organisms that remain within the disposal site dilution zone for an extended period of time, the discharge of substantially better (or "cleaner") material on the sites would likely result in an aggregate condition comparable to the stated plan policy.

The dredger does not typically control the original discharge of chemicals of concern into the aquatic environment. Nevertheless, the PSDDA study has highlighted the importance of the PSWQA goal relative to "reducing or eliminating discharges of toxic contaminants" into the Sound. As this goal would be achieved through improved source control, material dredged from the Sound's waterways should improve in quality, as should the condition at the disposal sites. Consequently, source control must remain a high priority for protection of the Sound.

For the reasons described above, the PSDDA selected alternative for Elliott Bay is considered to be consistent with the 1987 Puget Sound Water Quality Comprehensive Plan.

(8) American Indian Religious Freedom Act. The American Indian Religious Freedom Act of 1978 (AIRFA) requires Federal agencies to ensure that none of their actions interfere with the inherent right of individual Native Americans (including American Indians, Eskimos, Aleuts, and Native Hawaiians) to believe, express, and exercise their traditional religions. These rights include access to religious sites, use and possession of sacred objects, and the freedom to worship through traditional ceremonials and rites. The AIRFA requires coordination between Federal agencies and Native Americans to ensure that federally supported projects or projects on Federal land do not infringe on the religious practices of Native Americans.

Coordination between PSDDA agencies and potentially affected tribes has occurred throughout the study, and is an ongoing process.

4.09 Alternative EB2-II: Elliott Bay Site 2 With Site Condition II. Many of the potential environmental effects of disposal of dredged material at the alternate site in Elliott Bay (site 2) are similar to those of the selected alternative (site 1). This is a direct result of the site identification process: both sites are located in relatively nondispersive environments and are positioned to minimize disturbance to key bottom resources. Differences in their physical, biological and human environments, and consequent differences in environmental effects that would result by their use as dredged material disposal sites, are described below.

a. <u>Impacts and Their Significance to the Physical Environment</u>. Environmental consequences from disposal of acceptable (per Condition II) dredged material at the Elliott Bay site 2 would be the same as those described for site 1 above for air quality and land. Data from both the depositional analysis and current meter studies (DSITA, 1987) suggest that site 2 is less depositional than site 1. Currents in the vicinity of site 2 peaked at 37.5 cm/sec (1 percent peak), in excess of the 25 cm/sec site identification guideline, suggesting that material deposited at this site could occasionally be resuspended and transported offsite. This potential transport route could adversely effect sediment composition off site.

Water quality at site 2 is substantially better (State Water Quality Class "AA" - extraordinary) than that found at site 1 (Class "A" - very good). As a result, local adverse effects to water quality that would occur within approved mixing zones during disposal operations, even though they would be the same as discussed for site 1, they would be more noticeable, and perhaps more significant, at site 2. However, these effects are still not considered significant due to their short-term persistence and the nature of the material that would be discharged.

b. <u>Impacts and Their Significance to the Biological Environment</u>. Environmental effects resulting from the disposal of acceptable (per Condition II) dredged material at site 2 in Elliott Bay would be similar to those described for site 1 above for flora, benthic invertebrates, crabs, anadromous fish, birds, marine mammals and threatened and endangered species. Although some differences in impact are expected between the two sites, the differences are not expected to result in significant differences in impacts to resources.

Use of site 2 in Elliott Bay would result in a lesser loss of shrimp from the disposal site when compared to site 1, as shrimp were measurably less abundant at site 2 (DSS TA, 1987). Differences between the sites, which varied by season, were most prominent during September, when the preferred site contained many more shrimp (322-885/ha) than site 2 (44-80/ha). In June, site 2 contained more shrimp (175/ha) than the preferred site (81/ha). However, during the primary dredging period in Elliott Bay (February-March), the preferred site had an average count of 300 shrimp per hectare, compared to 44 per hectare for site 2.

Use of site 2 for dredged material disposal would result in burial or displacement of those shrimp found in the site during disposal operations. Surviving or returning individuals could experience sublethal adverse effects due to chemical concentrations present in the material on site, as long as they are not buried or displaced by further disposal activity. To the extent that the surrounding environment is at carrying capacity for these species, the displaced shrimp may experience reduced survival on a population basis. The abundance of shrimp found on site 2 is considered to be low when compared to numbers found in shallower waters or in harvested areas of the Sound. As a result, adverse effects to shrimp for this alternative are not considered to be significant.

Bottom fish at site 2 are slightly less abundant than those found at site 1. Essentially absent from the sites during the February time, bottomfish at site 2 were measurably fewer during June (15/ha) relative to site 1 (53/ha). A similar pattern was observed in September. Given their relative absence from the site, and their overall low numbers at the site relative to site 1 and to shallower waters, the impacts to these species resulting from the disposal of suitable dredged material at site 2 are not considered significant.

c. Impacts and Their Significance to the Human Environment. Use of the Elliott Bay site 2 with acceptable (per Condition II) material would result in the same impacts as those described for site 1 for social economic values, transportation, and human health. Consequences to these resources would be the same for both sites. In addition, though dredging and disposal activity would experience some additional time (and possibly costs) to transport the dredged material to site 2 when compared to site 1, these impacts would not be measurably significant.

Native American fishery activity at site 2 is less concentrated than it is around site 1. However, coordination between tribal fisheries and disposal operations is expected to avoid conflicts, as outlined in section 2. Biological impacts to salmonids would be similar to those presented for the preferred alternative.

The presence of a residential area on the beach and cliffs near site 2 presents a potential for adverse effects to occur relative to increased noise and reduced esthetic quality of the area. These effects are associated with tug noise during disposal operations, related disruption of the visual esthetics of the area as seen from shore, and the potential presence of a visible turbidity plume within the mixing zone. The degree of these effects would be essentially the same as experienced in the area during use of the existing disposal site at Fourmile Rock. Noise controls that prohibit night-time disposal would also continue to ameliorate the impacts of site use. While the effects would be more measurable and noticeable than at site 1, given the intermittent use of the site, the presence of numerous other navigation-related activities in the area, and the short-term persistence of disposal operations, adverse effects to noise and esthetic qualities are not expected to be significant for this alternative.

4.10 Alternative EB1-I: Elliott Bay Site 1 With Site Condition I. Analysis of the environmental consequences of the Site Condition I alternative for Elliott Bay is provided here in comparison to the effects of the preferred alternative (Site Condition II). In general, the adverse effects of these two alternatives are very similar in type, differing primarily in degree of effect in the various disposal environments. Somewhat less material would be suitable for unconfined, open-water disposal for Site Condition I than for the preferred alternative. This would result in fewer or decreased adverse effects in the aquatic environment, and additional or increased adverse effects in the land and shore environments.

While this alternative would result in less material placed at the unconfined, open-water site, the spread of the material would cover a comparable bottom area at the site though the depth of cover would be less. Consequently, differences between Site Condition I and Site Condition II in physical impacts to site species would not be significant. The major differences between Site Condition I and Site Condition II result from either the different degree of chemical concentration placed at the various site types and/or from the different distribution of dredged material among the disposal options (unconfined versus confined).

In Elliott Bay, application of Site Condition I would result in a slightly lower volume (3,113,000 c.y.) of material being found acceptable for unconfined, open-water disposal in the next 15 years than for Site Condition II (3,374,000 c.y.).

The following subsections describe the differences in environmental consequences that would result from the application of Site Condition I compared to those incurred by use of Site Condition II.

a. Impacts and Their Significance to the Physical Environment. Site Condition I would shift the primary water quality effects to nearshore, ground water, and freshwater areas, with fewer effects at the aquatic site compared to Site Condition II. A greater potential for chemical impacts to ground water and surface water is possible under this alternative compared to the preferred alternative, especially if design features are not used, or fail. As with Site Condition II, the effects at the unconfined site are intermittent and short-term, and are not considered significant.

Compared to Site Condition II, Site Condition I would result in minimally different physical effects and modifications of marine sediments at the unconfined site due to the similar spread and distribution of the dredged material. However, due to lower chemical concentrations in the dredged material, Site Condition I would result in a potential for fewer adverse effects within the unconfined site than Site Condition II. On balance, the potential for technological control (more material would be placed in upland and nearshore sites where control technology can be more easily applied) provides the opportunity for Site Condition I to result in overall fewer adverse effects to sediment quality than with Site Condition II.

Fewer barges utilizing the unconfined site means that fewer potential adverse effects to air quality would result at the site. However, the transport of the material via more trucks would mean a shift of air quality impacts to the land/shore environments, in closer proximity to human use. Overall, the adverse effects of Site Condition I to air quality are considered more substantive than those of Site Condition II. Though they would vary by the site being used, they are not likely to be significant.

For the dredged material that is not acceptable for unconfined, open-water disposal under the Site Condition I option, an estimated 274 acres of land (see table 4.3) could be impacted due to use of land and shore habitats in the

Elliott Bay area. When the total estimated water and land/shore acreages are combined for each alternative, Site Condition I would result in more (415 water plus 274 land equals 689 acres) commitment of land than Site Condition II (681 total acres). The overall significance of Site Condition I effects to land compared to Site Condition II would depend on the relative value ascribed to the aquatic and land/shore acreages.

b. Impacts and Their Significance to the Biological Environment. Site Condition I would result in fewer effects to aquatic flora at the unconfined site, because a smaller volume of material would be discharged at the site and that would have less potential for chemical effects. On land and nearshore environments, however, an increase in impacts to plants is possible. This is due to both an increase in acreage needed for disposal (loss of natural habitat) and placement of a greater volume of sediment with chemicals of concern in these environments. Overall, Site Condition I would result greater adverse effects to flora than for Site Condition II, because of the added impact to plants under Site Condition I.

For invertebrates, the adverse physical effects of Site Condition I would be similar at the unconfined, open-water site as those of Site Condition II, though added physical losses of intertidal and subtidal shoreline habitat would occur.

Site Condition I results in fewer adverse effects to invertebrates than Site Condition II, as chemicals of concern would be substantially placed elsewhere.

Aquatic marine fauna at the disposal site would be at less risk with Site Condition I than with Site Condition II. However, increased potential loss of shoreline habitat could significantly effect salmonids. The overall significance of using to Site Condition I, compared to Site Condition II, depends on the relative value ascribed to these habitats and species.

As with the case for Site Condition II, minimal impacts to waterfowl are expected from the disposal of dredged material suitable for Condition I at the open-water disposal site. Because of the potential loss of additional important habitat on land under this alternative, there is a greater probability for adverse impacts to birds than with Site Condition II. The same situation exists for threatened and endangered species. Though the species at risk would differ in the water and land areas, direct loss of land habitat represents a greater risk to these protected animals than do the disturbances at the open water site.

c. Impacts and Their Significance to the Human Environment. Compared to Site Condition II, social economic impacts of Site Condition I would be primarily associated with greater land use issues and greater cost to navigation and marine-related industries. These would be associated with somewhat lesser risks to the aquatic site and greater risks to land and shore environments. In addition, truck transport of dredged material has the potential of adversely affecting traffic in and around land/shore disposal sites. Again, the overall significance of these tradeoffs depends on socially ascribed values to the impacted resources.

In Elliott Bay, the estimated volume of dredged material that would meet Condition I over the next 15 years is 3,113,000 c.y. (or 30 percent of the 10,525,000 c.y. forecasted for Elliott Bay). Compared with activity expected if Site Condition II were adopted, the overall impact of Site Condition I on dredging activity could be to delay the initiation of new projects and extend the ongoing navigation maintenance cycles. The primary reason for the delays would be the increase in project costs associated with having to place dredged material exceeding the Site Condition I at other disposal locations. Additional delays would result during identification, designation, acquisition, and development of upland and nearshore disposal sites. Without considering the expenses associated with project delays, the added cost of Site Condition I in Elliott Bay would be almost $4 million (Condition I: $165,405,000; Condition II: $161,556,000).

Under this alternative, there would be less barge traffic at the open water site, with fewer potential fishery conflicts and need to coordinate dredging activities. However, increased use of shoreline and land disposal sites could result in overall greater potential adverse effects to resources and areas of importance to tribal fisheries. In addition, barge traffic would persist to some nearshore sites. Given the low degree of potential conflict that would exist with the unconfined, open-water site with any alternative, the increased effects on land and shore areas suggest that Site Condition I would result in more significant adverse effects to Native American concerns than would Site Condition II.

No difference in effects to human health would result from seafood consumption. Given the conservative approach applied in defining the site management conditions, Site Condition I should result in less risk to human health via seafood consumption than Site Condition II due to overall less volume and lower chemical concentrations that would go the unconfined, open-water sites. For both alternative Conditions I and II, the adverse effects to human health are not expected to be significant.

Site Condition I would increase the potential for adverse effects to human health in the land and shore environments. Increased risk of drinking water chemical impacts would result at upland sites. Dust and direct exposure to the dredged material also represent concerns at land and shore sites. By proper technology control, it is possible to limit the primary exposure to individuals that must work on or around sites during dredged material discharge and site completion or modification. Though the actual risks and effects would be site specific, on balance, Site Condition I has the potential for greater adverse effects to human health than does Site Condition II.

Noise impacts at the open-water site would be fewer with Site Condition I, but there would be measurably more noise effects at land and shore sites. Overall, the adverse effects to noise resulting from Site Condition I are considered more significant than those of Site Condition II.

d. Cumulative Effects. The location of the disposal site in Elliott Bay significantly contributes to the avoidance of direct and indirect adverse effects to important human and environmental resources. The potential for

reduced chemical releases into Puget Sound waters during disposal operations would result with Site Condition I relative to Site Condition II would not offset the increased loss of land and nearshore habitat that would also occur. Though the consequences to land are site specific, given past disturbances of shoreline environments, the potential exists for significant cumulative effects to occur with nearshore disposal sites. Consequently, Site Condition I has the potential for greater cumulative effects to the environment than Site Condition II.

4.11 Alternative EB1-III: Elliott Bay Site 1 with Site Condition III. Analysis of the environmental consequences of the Site Condition III alternative for Elliott Bay is provided here in comparison to the effects of the preferred alternative (Site Condition II). In general, the adverse effects of these two alternatives are very similar in type, differing primarily in degree of effect in the various disposal environments. With Site Condition III, almost all dredged material would be acceptable for unconfined, open-water disposal than for the preferred alternative. Of the 10,525,000 c.y. of material forecasted for dredging, 6,162,000 c.y. is estimated to be found suitable per Site Condition III. This would result in greater adverse effects to the aquatic environment, and a decrease in adverse effects to the land and shore environments.

Though this alternative would result in more material placed at the unconfined, open-water site, the spread of the material would cover a comparable bottom area at the site. Consequently, differences in physical impacts to site species for Site Condition II and Site Condition III would not be significant. The major differences between Site Condition III and Site Condition II would result from the different levels of biological effects permitted due to chemicals in the dredged material.

In Elliott Bay, application of Site Condition III would result in more volume (6,162,000 c.y.) of material suitable for the unconfined, open-water disposal sites in the next 15 years than for Site Condition II (3,374,000 c.y.). The following subsections describe the differences in environmental consequences that would result from the application of Site Condition III compared to those incurred by use of Site Condition II.

a. Impacts and Their Significance to the Physical Environment. Compared to Site Condition II, Site Condition III would shift the primary water quality effects from nearshore, ground water and freshwater areas, to the aquatic site. Water quality at the open water disposal site could experience overall greater adverse effects with the Site Condition III alternative. Potentially significant contributions to the sea surface microlayer and nepheloid layer are more possible with Site Condition III. As with Site Condition II, however, the impacts to water quality at the unconfined site are expected to be intermittent and short-term, and are not considered significant.

Compared to Site Condition II, Site Condition III would result in similar physical effects and modifications of marine sediments at the unconfined site due to the volume and grain size distribution of the material. This would result in a similar spread and distribution of the dredged material. However,

due to higher chemical concentrations present in the dredged material, Site Condition III could result in greater adverse effects at the unconfined site than Site Condition II. Sediment quality could be significantly altered by use of Site Condition III, which may possibly lead to unacceptable adverse effects on biological resources. On balance, the lack of technological control associated with open-water disposal (relative to upland and nearshore disposal) provides the opportunity for Site Condition III to result in overall greater adverse effects to the environment than with Site Condition II.

More barges would utilize the unconfined site, however, the increase in barge traffic would not result in any change in impact to air quality at the open-water site. The reduction in transport of the material via more trucks would mean a shift of adverse effects to air quality from the land/shore environments to the water environment. Overall, the adverse effects of Site Condition III to air quality are considered less substantive to human health than those of Site Condition II. Though air quality would vary based on site-specific characteristics, they are not likely to be significant in most cases.

For dredged material that is not acceptable for unconfined, open-water disposal under the Site Condition III option, an estimated 162 acres of land and shore habitats (see table 4.3) could be impacted in the Elliott Bay area. When the total estimated water and land/shore acreages are combined for each alternative, Site Condition III would result in much less land (677 acres) committed than Site Condition II (681 total acres). The overall significance of Site Condition III effects to land compared to Site Condition II would depend on the relative value ascribed to the aquatic and land/shore acreages.

b. Impacts and Their Significance to the Biological Environment. Site Condition III would result in more adverse effects to aquatic flora at the unconfined site, but potentially less adverse effects to plants and terrestrial animals in land and shore areas than with Condition III.

For invertebrates, the adverse physical effects of Site Condition III would be greater at the unconfined, open-water site as those of Condition II. A greater number of species would be expected to exhibit acute and chronic effects with Condition III than with Condition II. Crab and shrimp populations found in the area may also be significantly impacted by disposal using Site Condition III relative to Site Condition II because of the greater concentration of chemicals and potential for increased risk to the nepheloid layer.

For birds, terrestrial wildlife, and threatened and endangered species, there would be an overall reduction in impact associated with Site Condition III compared to Site Condition II. For aquatic species listed as threatened or endangered, risks would be higher; however, the area around the open-water site is not utilized by these species.

c. Impacts and Their Significance to the Human Environment. Compared to Site Condition II, Site Condition III would reduce the number of land use issues, as open-water disposal would be a primary method for disposal of

dredged material. Land issues that remain, however, could be significant because dredged material that does not meet Site Condition III requirements would have to be placed at a confined site.

In Elliott Bay, the estimated volume of dredged material that would meet Site Condition III over the next 15 years is 6,162,000 c.y. Compared with activity expected if Site Condition II were adopted, no overall impact of Site Condition III on dredging activity would be expected. The cost of Site Condition III in Elliott Bay is estimated at $118,578,000 compared to $161,556,000 for Site Condition II.

With Site Condition III activity, there would be more barge traffic at the open-water site, with a greater potential for fishery conflicts and need to coordinate dredging activities. The decreased use of shoreline and land disposal sites could result in lowering the adverse effects to resources and areas of importance to tribal fisheries. In addition, barge traffic would persist to some nearshore sites, as well as to confined aquatic disposal sites. Given the low degree of potential conflict that would exist with the unconfined, open-water site with any alternative, the increased effects on land and shore areas suggest that Site Condition III would result in more significant adverse effects to Native American concerns than would Site Condition II.

There would be no different effects to human health resulting from the seafood consumption route via Site Condition III. However, given scientific uncertainties in the chemical effects though conservative, it can still be said that Condition III would result in greater risk to human health via seafood consumption than Condition II due to overall greater volume and higher chemical concentrations that would go to the unconfined, open-water sites. For both alternatives, the adverse effects to human health are not expected to be significant.

Site Condition III would significantly decrease the potential for adverse effects to human health in the land and shore environments. Overall risks to drinking water would decrease as a result of less use of upland sites. However, the material that does require confined disposal would have high levels of chemicals and could result in an increase in site-specific impacts in ground water and freshwater quality. Though the actual risks and effects will be site specific, on balance, Site Condition III has the potential for lower adverse effects to human health than does Site Condition II.

Noise impacts at the open-water site would be about the same as with Site Condition II, but there will be measurably less noise effects at land and shore sites. Overall, the adverse effects to noise resulting from Site Condition III are considered to be less significant than those of Site Condition II.

d. Cumulative Effects. The location of the disposal site in Elliott Bay significantly contributes to the avoidance of direct and indirect adverse effects to important human and environmental resources. The increase in chemical loading to the Sound that would result with Site Condition III relative

to Site Condition II could have a greater cumulative effect on marine ecosystems, though this is not possible to quantify.

4.12 Selection of the Elliott Bay Alternative. Of the alternatives considered for the Elliott Bay area, including the No Action alternative, the selected alternative is alternative EB1-II: unconfined, open-water disposal site 1 and Site Condition II material. Several factors, discussed below, are significant in the preference for this alternative.

Both sites considered for Elliott Bay meet two key site identification factors: (1) the site should be located in relatively nondispersive environments and (2) are positioned to minimize disturbance to key biological resources. Site 1 was found to have an overall lower potential for impact to biological resources and the human environment than would site 2.

The most important difference between site 1 and site 2 concerning their acceptability as unconfined, open-water disposal sites is the fact that site 2 is in a more dispersive environment than is site 1. Peak currents at site 2 are at a high enough velocity to suggest that some deposited dredged material would be resuspended. Resuspension of dredged material could contribute to the nepheloid layer, transport off the site, and result in potential impacts to biological resources offsite, beyond the disposal site.

On the whole, site 2 has a lower biological resource value than does site 1. Site 2 contains low concentrations of shrimp, while site 1 contains commercially harvestable levels. Site 2 also contains lower numbers of bottom fish than does site 1. However, the potential for transport of dredged material offsite and for impact to resources offsite make site 2 the less environmentally desireable choice.

Site 1 is closer to Native American fishery activity; however, site 2 is closer to residential areas and beaches. In addition, part of the site 2 boundary overlaps with the current disposal site at Fourmile Rock. Use of site 2 could complicate monitoring efforts of the PSDDA site (because of past use of the Fourmile Rock site.

The selected site in Elliott Bay (site 1) would result in somewhat greater adverse effects on shrimp than site 2 due to displacement of observed shrimp and associated sublethal effects to the remaining or returning individuals. On the other hand, the location of site 1 was chosen to ensure that dredged material placed onsite would remain onsite and no unacceptable adverse impacts would occur. The selected site is relatively more depositional per existing information than the alternate site (site 2). In addition, public input received during the study and at the final public meetings (February 1988) clearly favored the selected site. Avoiding residential shoreline areas, with associated noise and esthetic impacts, favors site 1 over 2. In terms of using dredged material to cover existing areas having elevated levels of chemicals, site 1 is also preferred. Material placed at site 1 would be covered more rapidly by natural sedimentation than at site 2, and therefore

return more rapidly to a natural state when the site was no longer used. On balance, the advantages of site 1 substantially outweigh the disadvantages relative to site 2.

The selection of the biological effects condition for site management is based on consideration of the overall environmental effects of the dredged material disposal program (including both aquatic and land/shore effects). In order to ensure consistency throughout the region, these assessments were made for the entire Phase I (central Puget Sound) area.

Dredged material discharged at the unconfined, open-water site must be acceptable for maintaining the chosen site management condition. Under Site Condition II, dredged material deposited at Elliott Bay site 1 would not have an unacceptable adverse effect on biological resources at or around the disposal site or to human health. Impacts that do occur to aquatic species would be confined to the disposal site (no unacceptable effects offsite) and would not exceed sublethal chemical effects to the few remaining and more sensitive species on site (i.e., significant acute toxicity would not be present on site). A monitoring plan developed for the PSDDA disposal sites will be used to ensure that effects at the disposal site do not exceed Site Condition II limits and that unacceptable offsite impacts are not occurring. If monitoring indicates that impacts are exceeding predictions, appropriate site management response would be taken.

Site Condition I would reduce adverse effects to the aquatic environment relative to Site Condition II, but would relatively increase adverse effects to land and shore environments. Site Condition III, on the other hand, would result in much greater adverse effects to the aquatic environment then would either Site Condition I or Site Condition II with almost no impacts to land and shore environments.

Costs for testing, dredging, disposal, and monitoring of the volume of sediment that is forecasted to require removal over the next 15 years in the Elliott Bay area under Site Condition I would be approximately $165.4 million, Nearly $4 million more than the costs of disposal under Site Condition II ($161.6 million). Dredged material disposal under Site Condition III would cost about $118.6 million, about $43 million less than Condition II.

The selected alternative is consistent with Section 404 of the CWA which governs the discharge of dredged material in nearshore waters of the United States. Under section 404(b)(1) no "unacceptable adverse effects" can result from the discharge of dredged material in open-water sites. Research and analysis of data used to define the alternative site conditions indicate that disposal under Site Condition II material would not result in unacceptable adverse effects on aquatic resources. The selected site management condition would, furthermore, not allow significant acute toxicity onsite, thus meeting State water quality standards and the condition frequently used in the implementation of Section 404 nationwide.

In considering the overall effects (total impact of dredged material disposal) to land and water, the use of Site Condition II is considered the environmentally preferred approach and was therefore chosen. Additionally, alternative EB1-II, site 1 and Site Condition II, most closely meets the stated PSDDA goal to provide for publicly acceptable guidelines governing environmentally safe unconfined, open-water disposal of dredged material in Puget Sound.

ENVIRONMENTAL EFFECTS OF THE
ALTERNATIVES CONSIDERED FOR PORT GARDNER

4.13 Alternative PG1-2: Port Gardner Site I with Site Condition II - Selected Alternative. The final EIS alternatives evaluated for the Port Gardner area are shown in table 4.11.

a. Impacts and Their Significance to the Physical Environment.

(1) Water Quality.

(a) Marine Water. Disposal activities at the selected site are not expected to significantly affect water quality conditions (i.e., currently Class A waters) in Port Gardner, except in the immediate vicinity of the disposal site.

Some short-term water quality impacts are anticipated within the disposal site dilution zone following disposal of suitable dredged material from bottom dumped barges due to elevated levels of suspended solids within the dredged material plume. Water quality monitoring of an experimental disposal site in Elliott Bay during and after disposal operations for a period of 9 months showed no significant long term impacts to water quality (Baumgartner et al., 1978; Schell et al., 1978; Pavlou et al., 1978). Transient impacts observed were some elevated levels of PCB (i.e., increases from 3 ng/l to as high as 3 ug/l), d-Mn, and NH_3-N, which were all associated with increased suspended solids levels and were short term (generally minutes) in duration. No important chemical changes in the water column were documented during disposal activities at the Columbia River ADFI site located off the mouth of the Columbia River, or at other sites throughout the country during the DMRP (Dredged Material Research Program) (Wright, 1978).

TABLE 4.11

FINAL EIS ALTERNATIVES EVALUATED FOR PORT GARDNER

EIS Alternative	Description	Addressed in EIS Section
PG1-II	Port Gardner Site 1 and Site Condition II (selected alternative)	4.13
PG2-II	Port Gardner Site 2 and Site Condition II	4.14
PG3-II	Port Gardner Site 3 and Site Condition II	4.15
PG1-I	Port Gardner Site 1 and Site Condition I	4.16
PG1-III	Port Gardner Site 1 and Site Condition III	4.17
Selection of Port Gardner alternative		4.18

Through a suggested source of chemical contribution to the sea surface microlayer, dredged material chemical input to the microlayer has not been verified or quantified, but is not considered significant relative to other probable sources from permitted discharges (i.e., sewage effluent) (Word and Ebbesmeyer, 1985; Word et al., 1986; Hardy and Cowan, 1986). Contributions to the sea surface microlayer will continue to occur from a variety of sources, including airborne sources (dry particulate fallout, precipitation, gases, and depositional materials), land sources (including shoreline erosion, river runoff, discharge of sewage and industrial effluents, and spills from vessels and land based facilities), and nearshore sediments (through upwelling, bubbles, or biochemical transformations). Observations of shoreline contamination in Puget Sound strongly implicate sewage discharges and street runoff as primary causative agents (Word and Ebbesmeyer, 1984). A review of the literature on sea surface microlayer composition, sources, and impacts on phytoplankton and phytoneuston is presented in a PSDDA report prepared by Word, et al. (1986). To ensure that the dredged material operation does not result in the release of unacceptable concentrations of chemicals into the water column, the PSDDA evaluation procedures call for water column testing, if warranted, on a case-by-base basis.

In addition to the above impacts, suspended dredged material may become incorporated in the nepheloid layer that is found near the sediment/water interface. A quantitative estimate of the amount of disposed material that might become associated with the nepheloid layer is not possible, however, the level of contribution is not expected to be significant. Indirect evidence of dredged material contribution to the nepheloid layer was seen in research conducted during the Field Verification Program (FVP) in Long Island Sound. Benthic species near the disposal site exhibited increased levels of certain chemicals during disposal activities. Following disposal, however, tissue residue values dropped to background levels in organisms collected near the disposal site (FVP study, 1987). The PSDDA monitoring plan for the unconfined, open-water sites calls for collection of tissue residue data for benthic species collected off the disposal site to further evaluate any potential impacts to the nepheloid layer.

In conclusion, only transient and temporary changes in suspended solids levels and increased levels of sediment-bound chemicals are expected during disposal activities, with no significant adverse impacts to water quality anticipated.

(b) Freshwater and Ground Water. Impacts to freshwater and ground water quality can arise from two potential sources: (1) release of chemicals in effluent during dewatering or from uncontrolled runoff, and (2) release of chemicals via leachate from confined sites which could enter ground water. Impacts from effluent or uncontrolled runoff depend on the type of water (hard versus soft) and the existing water quality of the receiving waters. The degree of chemical release associated with effluents can be controlled through a variety of technologies including construction of wiers and settling ponds.

Significant adverse impacts on ground water may result from the production of leachate containing chemicals of concern at the disposal site. Because of the geochemical changes that are associated with drying and oxidation, a large fraction of sediment chemicals can be mobilized. The magnitude of the impact of leachate production on ground water quality would depend on the chemical composition and physical characteristics of the dredged material, the characteristics of the interfacing soils, and the planned use of the underground receiving waters. The relative potential for freshwater and ground water chemical release under this alternative is less than the impacts that would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal site and greater than the impact if Site Condition III material had been chosen.

(2) Marine and Estuarine Sediments. The Port Gardner site is situated in a depth of 420 feet on a comparatively flat plain. Bottom slopes are less than 1 foot of vertical elevation on 200 feet of horizontal distance. Therefore, bottom slopes are not expected to influence the shape of the disposal site. Tidal current and depositional analysis data indicate that the site is subject to weak currents. Since the mean speeds near the bottom averaged 0.25 feet per second at the center of the preferred disposal site, the closest disposal model results (400-foot depth and a 0.1 feet per second current; DSSTA, 1987) were used to estimate the extent of dredged material deposition within the disposal site. Because bottom slope and tidal currents should not significantly alter the disposal site configuration, the delineated site is a 4,000-foot-diameter circle that is concentric with the 1,800-foot diameter water surface disposal zone. If dredged material is dumped at random within this 1,800-foot-diameter zone, at time of site capacity the disposal mound could take the form of a truncated cone that has a base diameter of 4,000 feet, a height of 34 feet and a top radius of 1,000 feet. Since both ambient current speeds and sediment deposition rates are very low in the vicinity of the proposed site, the mound that is formed by the disposal of dredged material would remain relatively unchanged in the forseeable future. Assuming that an annual average of the volume that could be discharged at the selected site over the period 1985-2000[1/] is experienced beyond the year 2000, the estimated site capacity would be reached in year 2014.

Surface sediments at Port Gardner site 1 are primarily fine mud and clays (DSSTA, 1987) and the site appears to be a site of net deposition. Material expected to be disposed at the open-water site would range in grain size from primarily silt and clays to material that is primarily sand. Although some changes in grain size distribution at the disposal site can be expected due to disposal of Port Gardner area dredged material, these impacts are not expected to have a significant, adverse impact on the sediments of the area.

Sediment chemistry analyses of samples from the area of site 1 indicate that the sediments do not contain elevated levels of chemicals of concern (Tetra Tech, 1986). Disposal of dredged material allowable under Site Condition II

1/See table 4.2c.

would increase sediment chemical levels within disposal site 1. See Section b., "Impacts and Their Significance to Biological Environment" for a discussion of the possible impacts to biological resources due to potential increases in sediment chemicals onsite.

(3) Air Quality. No significant loading of concern chemicals to the existing air environment are anticipated as a result of forecasted disposal activities at the preferred site in Port Gardner. Tugboat towing of barges to the disposal site is expected during the normal 30 to 35 days of average annual site usage. during this usage, on the average about 2 to 3 barges per day would be discharging at the site with peak activity of 5 barges per day (table 4.9).

Some hydrocarbon releases, including hydrocarbon byproducts and particulates from diesel fumes would be released during disposal activities at both the open-water site and at upland and nearshore sites. Negligible concentrations of hydrogen sulfide gas may also be released from the dredged material during open-water disposal activities. In summary, no significant impacts are anticipated to the air quality environment in Port Gardner as a result of disposal activities due to the selected alternative.

(4) Land. Habitat impacts associated with dredged material that must be placed in other disposal sites (benthic/land/shore/confined) could include loss of wetlands, loss of fish feeding and rearing habitat, loss of land vegetation, and loss of natural shoreline areas (see sections 2.03 and 4.01 above). An estimate of the possible land/shore losses of habitat was developed for the Port Gardner selected alternative (table 4.3), indicating that approximately 318 acres of benthic area would be covered by the preferred open-water disposal site while land and shore losses would approximate 10 acres. It is not possible to further quantitatively distinguish between upland and nearshore losses. Though development of shoreline areas in the Port Gardner area have been less extensive than in the other two Phase I bays (Commencement and Elliott bays), the steep relief of the land and the overall high environmental value of the river delta minimize the availability of suitable land and nearshore disposal sites. It is possible that land/shore disposal in this area would occur in a diked wetland area, given their relative abundance, with consequent environmental losses.

b. Impacts and Their Significance to Biological Environment.

(1) Flora.

(a) Marine and Intertidal. Little impact to marine and intertidal species is expected under this alternative. Impacts that would occur to intertidal and subtidal macroalgae and eelgrass would primarily be due to the introduction of short-term pulses of suspended materials from effluent outfalls that could interfere with photosynthesis by reducing light availability. This impact would be expected to be minor and confined to the area around the outfall and can be reduced through proper control of effluent

discharge. Relative impacts under this alternative would be less than those predicted if Site Condition I material had been chosen for the unconfined, open-water disposal sites and greater than impacts if Site Condition III had been chosen.

(b) Terrestrial. Significant adverse impacts to terrestrial plants can result with disposal of dredged material at confined upland sites. Site preparation requires complete destruction of the existing habitat including removal of vegetation and possibly excavation of top soil (which can be used to construct dikes, berms or stored for later use as a soil cap) (Canter et al., 1977). Under this alternative, approximately 10 acres of upland and nearshore area would be used to develop confined disposal sites. The impacts to plant communities under this alternative are greater than those associated with Site Condition III and less than the impacts associated with Site Condition I.

Following disposal, land sites may still present significant adverse impacts to plants recolonizing the area. High salt content and the presence of chemicals may hinder successful germination and growth of many plant species. In addition to slowing or preventing reestablishment of plant communities on site, vegetation around the perimeter of the disposal area may also be acutely impacted as a result of salt seepage (Harrison and Chisholm, 1974).

Once a disposal site is no longer in use, remedial action can be undertaken to rehabilitate the land, although this is often difficult to accomplish (Grosselink, 1973). Sites can be seeded with saline resistant plants or covered with enough top soil to act as an effective barrier between establishing plants and the dredged material. Additionally, dredged material can be deep plowed and limed to enhance soil conditioning prior to establishment of vegetation (CZRD, 1978).

(2) Plankton.

(a) Marine Phytoplankton. Impacts to phytoplankton would result during disposal operations from intermittent pulses of suspended material that could either promote and inhibit primary production. Turbid mixtures of organic and inorganic material both interfere with photosynthesis by shielding light and stimulate growth by raising inorganic nutrient levels above background levels. Impacts can also occur from suspended materials adhering to the surfaces of cells, interfering with gaseous/nutrient transport across the cell wall, possibly leading to mortalities. Also, phytoplankton in the path of the descending dredged material mass would be removed from the euphotic zone and lost (flocculated). The release of growth inhibitory substances from the dredged material may also occur. Concern chemicals released during disposal could result in inhibition of photosynthesis by interfering with metabolic pathways.

As disposal operations would not occur during the major portion of the spring bloom period due to closing for fishery protection, the high phytoplankton productivity at that time of the year would not be significantly impacted.

Disposal would occur, however, during the fall bloom period, so that impacts to the phytoplankton community may be somewhat more pronounced than during other times of the year. The overall impacts on primary production would be localized, are likely not measurable, and are not expected to be significant.

(c) Zooplankton. Impacts to zooplankton could result from suspended particles interfering physically with active feeding. In addition, suspended particle loads would dilute the concentration of food particles in the water for filter feeders and, in some instances, reduce the amount of available food (due to flocculation of phytoplankton).

Zooplankton in the immediate disposal area could become entrained by the disposal material with resultant mortalities. However, most zooplankton are spatially distributed over wide areas in the water column and any impacts at the disposal site would not be expect to significantly affect Port Gardner zooplankton community structure.

Any impacts to the Port Gardner zooplankton community would be localized and short term. Chemicals released from the disposal operation may have measurable, although short term and localized impacts. Localized impacts could include mortality, inhibition of growth and reproduction. However, the temporal nature of the disposal and the small percentage of zooplankton impacted relative to the existing bay-wide community, would render this impact insignificant.

(3) Invertebrates.

(a) Benthic Infaunal Resources. Two types of impacts would occur as a result of dredged material disposal at the selected PSDDA open-water site: (1) physical impacts, and (2) chemical impacts. Each is discussed in turn with respect to probable impacts to the sedentary benthic infaunal resources existing within the disposal site and immediately adjacent to it.

Anticipated physical impacts to sedentary benthic infaunal resources resulting from dredged material disposal in the selected site would include the immediate, but temporary, loss of benthos due to burial and smothering by clumps of cohesive material within the relatively small single dump bottom impact area ("250-foot diameter footprint," see section) of the overall disposal site. Direct physical impacts from dredged material hitting the bottom would be greatest in the center of the impact zone and diminishing to negligible impacts toward the edges of this zone. It is likely that some of the buried infauna would be able to survive initial burial by vertically migrating out of deposited material, particularly if they are covered by less than 20 cm of material. Several benthic infaunal species have demonstrated the ability to migrate vertically and survive burial induced by relatively thick covers (i.e., up to 50 cm) of sediments with particle size distributions both similar to, and different from, their preferred sediment habitat (Maurer et al., 1978).

During periods of dredging inactivity, partial recovery of benthos due to recruitment and migration from surrounding unimpacted areas could be

expected. Likely recruits to the disposal site may consist of polychaete opportunists such as Capitella capitata, Spiophanes fimbriata, and Boccardia polybranchia (Battelle Draft Report to EPA: Detailed Chemical and Biological Analysis of Selected Sediments From Puget Sound, 1985) as well as from resident bivalve species, such as Axinopsida sericata, and Macoma carlottensis. Recolonization may result in the partial restoration and/or possible enhancement of benthic habitat values to foraging bottom fishes (Rhoads et al., 1978; Becker, 1984; Lunz, 1986). Tatum (1984) reported an increase in benthic species abundance at an experimental disposal site in Elliott Bay following disposal operations. Recently, a BRAT survey of the Foul Area disposal site off the coast of New England showed that benthic resource food values on site were increased as a result of disposal activities relative to offsite conditions for many of the target flatfish foraging strategies examined, particularly fish foraging for smaller prey living near the sediment-water interface (Lunz, 1986).

Existing benthic communities found onsite are adapted to fine-textured, medium silt/coarse silt bottoms. Potential changes in bottom sediment grain size distribution resulting from dredged material disposal would likely have a detrimental impact on many of the resident infaunal species (i.e., due to lower reproductive potential, impaired recruitment success, and survival of young) as well as negatively influencing the ability of buried adults to vertically migrate and survive burial (Maurer et al., 1978).

Under the effects definition for Site Condition II (see chapter 2), some sublethal impacts to onsite benthos are possible from chronic exposure to dredged material. These impacts would be confined to the disposal site. The PSDDA monitoring program includes a check of benthic community health around the disposal site to ensure that unacceptable biological impacts are not occurring. The severity and extent of biological effects from the dredged material are not expected to be significant since the majority of the taxa found at the selected site (polychaetes, bivalves; Clarke, 1986) are not known to be acutely sensitive to chemicals of concern. Effects associated with the dredged material will include sublethal impacts, with potential increases in the mortalities of the more sensitive, but less abundant, crustacean species (section 3.02.b(1)(c)).

Cumulative effects of exposure to the dredged material could result in a reduction in population and community biomass of equilibrium (Stage III) species, with a corresponding increase in abundances and biomass of more pollution and physical disturbance tolerant pioneering (Stage I) species. This pattern will also be maintained by the periodic physical disturbance of the site during disposal operations. Tissue concentrations of contaminants may also increase in onsite benthos exposed to Site Condition II material.

Impacts that occur outside the disposal site would not be significant, consisting of food web impacts, and possibly sea surface microlayer impacts. The former involves mobile benthos (crab, shrimp, etc.) feeding on disposal site benthos and migrating offsite with a chemical body burden and contributing chemicals via predation or decomposition to bay food web. The degree of food

web transfer is unknown, but should not be significant, due to the nature of the site management condition and because few mobile species are present at the selected site. Nearshore, intertidal and subtidal invertebrate fauna would not be significantly impacted from the disposal operations due primarily to their distance from the disposal site. Existing sea surface microlayer chemicals may occasionally contact the nearshore benthos as a result of currents, tidal actions, and wind moving chemicals onshore. In the case of Port Gardner site 1, the probability that chemicals from the dredged material would significantly contribute to the existing contaminant load, with significantly increased impacts, is considered low. (Word and Ebbesmeyer, 1984; Word et al., 1986; Hardy and Cowan, 1986).

(b) Intertidal. Intertidal invertebrates would be impacted by any development of the nearshore environment for use as confined disposal sites. Physical impacts to sedentary species from dredged material disposal would be the immediate loss of intertidal communities due to burial during disposal activity. Effects observed at the nearshore site are expected to be sublethal in nature if material disposed in the nearshore environment contains chemicals in concentrations characterized as Site Condition II. Some acute impacts could be expected if dredged material exceeds Site Condition II. Species impacted would include copepods and gammarid amphipods, which can comprise 30 to 40 percent (by abundance) of the species present in intertidal communities. Chemical impacts are expected to be localized to the area immediate to the effluent outfall. Overall input to intertidal communities would be dependent on both the amount of nearshore area taken for disposal site use and the level of chemicals in the material disposed.

(c) Mobile Crab and Shrimp Resources. Physical disposal impacts on Dungeness crab (*Cancer magister*) at the selected site would be limited to the fall season, the only season when crabs, exclusively nongravid females, are present on the site. No high density crab concentration areas would be impacted, as onsite densities would be low (estimated average density of 25/hectare) and the disposal site is over 0.75 nautical miles from the nearest high concentration area. Disposal is not expected to impact these distant, high-density crab areas. Also, disposal operations would not significantly impact Dungeness crabs during the majority of their sensitive molting period, that occurs from April through June because no disposal would occur between April 1 and June 15 of any given year (due to Washington State Department of Fisheries standards for protection of migratory juvenile salmon). A very small percentage of the female crabs that migrate to the selected site in the late summer and fall months could be in the process of molting, concurrent with disposal operations, and these crabs would be more subject to disposal impacts. However, no molting females were caught during the onsite trawls in September by the University of Washington. Thus, impacts on Dungeness crabs at the selected site would be limited to disposal operations conducted during the fall months and would involve only female crabs, few or none of which were in the molting condition.

Dungeness crab in the selected site would be subject to both physical and chemical impacts from disposal of dredged sediments. Direct physical impacts

could result from crabs being struck by clumps of dredged material at or near the center of the disposal footprint. This could result in burial and impairment of the crabs' ability to vertically migrate, due to the sheer weight of material or to actual bodily damage. Some mortalities would be possible. Impacts would be greatest in or near the center of the disposal footprint, diminishing to negligible impacts towards the edges of the footprint. Unless the crab females are directly hit by a clump, it is expected they would survive, even in the footprint center. This is because of the slow rate of material accumulation, the thinness of material that would be deposited with each disposal, and the expected similarity in grain size between the disposal material and the site's existing sediment.

An additional, although minor physical impact would be due to the increases in suspended material with each disposal in the footprint area and adjacent nepheloid layer. This material could accumulate in the gills and interfere with normal gas exchange across gill surfaces. No mortalities would be expected; however, some crabs, especially those located near the center of the impact area would be stressed, and would likely leave the immediate disposal area.

Chemical impacts could result from chronic exposure to chemicals in the dredged material. These would be primarily sublethal and would be contained within the disposal site. Crabs exposed to the dredged material would include those present on the site during the disposal operations and those having inmigrated either randomly, or possibly in response to detection of food organisms in the deposited material. Predicting whether or not the latter will occur with any frequency is speculative because of an apparent lack of scientific literature that addresses the issue of adult crab migrations to dredged sediment in deepwater areas. In general, few crabs are expected to be drawn to the site because of water depths.

Sublethal effects would result from crabs being in direct contact with particle-bound chemicals and with those that become dissolved within the sediment pore water. Accumulation of these chemicals would occur to an extent dependent upon the concentration of the chemicals and their relative biological availability. The effects of biological accumulation of chemicals are not fully understood, although it is generally accepted that chronic impacts are due to chemicals that are biologically available, accumulated, and, in some instances, metabolically modified. Potential effects include: impairment of the molting process, reduced reproductive capability, decreased feeding ability, and decreased resistance to disease organisms.

Offsite impacts involving crabs would occur when crabs with tissue body burdens of chemicals migrate offsite or when crabs from offsite forage on benthic species inhabiting the disposal area.

In conclusion, potential disposal impacts to Dungeness crab in the selected site and vicinity would be limited to the fall season, when low numbers of females (nongravid) are present. Impacts on major crab concentration areas in Port Gardner would not occur due to the distances between the selected site

and these areas. Even with maximum expected disposal frequencies and quantities, only very few crabs would suffer mortalities, those being directly hit by large clumps of cohesive material. But the cohesive, clumped masses would only descend over about 14 percent of each disposal footprint, and the density of crabs (average of 25 per hectare) is so low that very few direct impacts would be anticipated. All other impacts described above would not be considered significant either onsite or offsite, comparing the relatively small 289-acre disposal site with the much larger Port Gardner deepwater area that supports large crab populations.

Disposal impacts on shrimp at the selected disposal site are expected to be similar to those predicted for Dungeness crab at this site. Only low abundances of shrimp are present at the site througnout the year, far below the level necesssary to support a commercial shrimp fishery.

Shrimp would be subject to both physical and chemical impacts from disposal of dredged material. Direct physical impacts would result from shrimp being struck by clumps of cohesive material at or near the center of the disposal footprint, a small area approximately 250 feet in diameter (see section 2). These encounters would result in burial and possibly impairment of the shrimps' ability to vertically migrate through the material due to the sheer weight of the material or to bodily damage. Some mortalities would be expected, but most shrimp would likely be able to survive the impact. Impacts would be greatest in or near the center of the 250-foot diameter disposal footprint diminishing to negligible impacts towards the aprons of the footprint.

An additional, although minor physical impact would occur due to increases in suspended material both in the immediate footprint area and in the adjacent nepheloid layer. Suspended material can accumulate in the gills and interfere with normal gas exchange across gill surfaces. No mortalities would be expected; however, some shrimp, especially those located nearest the center of the impact area, would be stressed and would leave the immediate disposal area.

Chemical impacts could result from long-term exposure to chemicals present in the dredged material. These would be primarily sublethal and would be more likely onsite. Shrimp exposed to the dredged material would include those present onsite during disposal operations, and those having inmigrated either randomly or in response to detection of food organisms in the deposited material. Sublethal effects would result from shrimp being in direct contact with particle-bound chemicals and with those that become dissolved within the sediment pore water. Tissue accumulation of these chemicals will occur to an extent dependent upon the concentration of the chemicals and their relative biological availability. Potential effects of accumulation include impairment of molting, reduced reproductive capacity, decreased feeding ability, and decreased resistence to disease organisms.

Offsite impacts involving shrimp could possibly occur when shrimp with tissue body burdens of chemicals migrate offsite, or when shrimp from offsite forage on benthic species inhabiting the disposal area. Assuming the dredged material contains approximately the same, or less, food value as the existing disposal site sediments, inmigration and emigration should be roughly balanced

and no significantly increased numbers of shrimp would be expected onsite. However, the degree of inmigration will depend to a large extent on the quantity of available food organisms in the deposited material.

In conclusion, disposal impacts to shrimp in the selected site and vicinity would be minor due to the relatively small cohesive clump impact area, the small build-up of disposed material over time, the ability of shrimp to escape high turbidity areas, and the relatively low density of shrimp present on the site throughout the year. No impacts to important shrimp populations in Port Gardner are anticipated.

(4) Fish.

(a) Anadromous Fish. Impacts of disposal operations on important juvenile salmon populations would be negligible, primarily because no disposal operations would occur between March 15 and June 15, the "window" designated by the Washington State Department of Fisheries to protect juvenile salmon and steelhead during outmigration. The majority of the juvenile salmon populations will have migrated out of Port Gardner by June 15.

Disposal would occasionally be coincidental with the presence of early or late migrants (especially chinook salmon) or with those species that may tend to remain in the bay for extended periods of time (e.g., searun cutthroat trout). These juveniles would not be impacted by the disposal operations unless they frequented the disposal area where they could pass through the turbidity plume and be subject to turbidity impacts. Impacts could include interference with oxygen exchange due to suspended solids clogging gill surfaces, and slightly lowered oxygen availability due to biological oxygen demand of the suspended dredged material that forms the disposal plume. Impacts to juveniles due to exposure to chemicals in the plume would probably be negligible as most chemicals would be unavailable, bound to the sediment particles rather than dissolved in the water column where they could be absorbed across gill surfaces. These impacts, if they occurred at all, would be minor since juveniles typically avoid disposal plumes, and the site is not located in primary juvenile migratory pathways.

Adult salmon and trout migrating through the bay would also not be significantly impacted by disposal operations as the majority of the fish will avoid disposal-associated turbidity plumes. Those fish that contact the plume however, would be temporarily impacted from short-term clogging of their gills, by suspended material, and from slight depressions in dissolved oxygen due to the biological oxygen demand of the dredged material. However, these conditions are far less severe than the fish usually encounter when they migrate up the Snohomish River during periods of floods or highwater.

Contribution of chemicals to the sea surface microlayer from Site Condition II dredged materials may occur, but is expected to be minor relative to existing levels of chemicals from other sources (Word et al., 1986; Hardy and Cowan, 1986). Actual chemicals and their concentrations would be difficult to identify/measure in view of many source contributions in Port Gardner. Adult

salmon may occasionally swim at the surface for short periods and therefore contact the microlayer during their milling behavior; however, physiological effects due to dredged material contaminants (in Site Condition II material) would not be expected to occur. For there to be a noticeable impact on adult salmon fished in the bay, the salmon would have to swim for extended periods of time at the surface and near to the disposal area or microlayer "plume" to absorb chemicals via the gills, possibly resulting in minor physiological impairments. Swimming at the surface for extended periods is not typical of migrating adult salmonids. In general, disposal operations involving material suitable under Site Condition II should not significantly impact physiological mechanisms/behavior patterns of adult salmon in Port Gardner Bay.

(b) Bottom Fish Resources. Negligible bottom fish resources were found on or near the selected site during site specific studies in September, June, and September 1986 (see section 3). It is therefore probable that the area in Commencement Bay occupied by the selected site does not represent prime bottom fish habitat. Nevertheless, some direct and secondary impacts to bottom fishes are expected to occur as a result of disposal of dredged material at this site. Clumps of cohesive material impacting the bottom may bury flatfish such as Dover sole within the "250-foot" diameter bottom impact area (see section 2). Any fish found outside the bottom impact zone would likely escape direct impacts, but may suffer some respiratory distress due to gill clogging and/or low dissolved oxygen levels (i.e., due to high COD/BOD levels), induced by elevated levels of suspended solids within the dredged material plume. It is highly likely that fish would avoid stressful levels of suspended dredged material by temporarily moving out of the area. In conclusion, because only low numbers of bottom fish resources were found onsite, direct physical impacts from disposal on these resources are not expected to be significant.

Bottom fish resources may also be affected through secondary impacts resulting from disposal of dredged material in the preferred disposal site. Benthic communities within the impact zone are expected to be temporarily lost as a result of burial and smothering, further lowering the value of the area as food habitat for bottom fish. As this area does not appear to be a prime feeding habitat area for bottom fish in general (Clarke, 1986), the impact of this habitat loss to fish resources is not expected to be significant.

Benthic resources, however, are expected to recover during periods of disposal inactivity. Fish food habitat values might even increase as a result of increased production of pioneering (stage I) opportunistic species on the disposal mound (Rhoads et al., 1978; Becker, 1984; Lunz, 1986). Bottom fish foraging on these opportunistic species may bioaccumulate chemicals through dietary intake of prey. Direct accumulation of chemicals might also occur through skin and gill membranes as a result of their intimate association with the bottom sediments, particularly when buried in the sediments. Because the area of the disposal site only represents a relatively small portion of the foraging habitat for demersal bottom feeding fish in Port Gardner, and documented fish food habitat resources onsite are uniformly low, only very low levels of chemical bioaccumulation in fish predators are possible.

(c) Freshwater Fishes. For disposal of material not suitable for unconfined, open-water disposal, impacts to freshwater fish would be a direct result of the introduction of effluent discharge into freshwater habitats. Two sources of impacts are associated with effluent discharge: (1) impacts due to increases in turbidity and siltation, and (2) impacts due to increases in chemicals.

Fish species in general, and freshwater game fish in particular, have a low tolerance for increases in turbidity (Canter et al., 1977). Fish mortality due to asphyxiation is often the result of the coating effect of fine particles settling on the gill filaments (Sherk and O'Connor, 1975). Eventual reduction in fish population size and even local species elimination have been found as a result of increasing turbidity levels in streams that typically had low background levels of suspended solids (Hollis et al., 1964).

Another possible impact due to turbidity and siltation on fish populations is through the reduction in spawning ground habitat (Hollis et al., 1964). Ripe running fish will abandon previously used spawning grounds if siltation is too great. Siltation will result in suffocation of fertilized eggs by reducing oxygen exchange across the egg surface.

Freshwater fish are generally more sensitive to chemicals of concern than are marine species and are therefore more susceptible to chemicals associated with effluent runoff from confined disposal sites. In addition, toxic metals are more readily available to organisms in freshwater than in saline waters, in effect increasing the exposure environment. The relative potential for impacts to freshwater fish under this alternative is less than the impacts that would be predicted if Site Condition I has been chosen for the unconfined, open-water disposal sites and greater than the impact if Site Condition III had been chosen.

(5) Terrestrial Wildlife. Development of upland and nearshore confined disposal sites would require the destruction of wildlife habitat and cause significant adverse impacts to terrestrial wildlife. The types of wildlife and number of species impacted by site construction would depend on the specific type of habitat being destroyed. Disposal site construction on a field would impact generally smaller-sized animals and relatively less diverse communities than would be expected if forested land were utilized as sites for confined disposal. The significance of the impact to terrestrial species will depend upon the availability of nearby habitat (and its carrying capacity) to assimilate displaced wildlife. Relative impacts under this alternative will be less than those predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites and greater than impacts if Site Condition III had been chosen.

(6) Birds.

(a) Water Birds. The only direct impacts of open-water disposal on waterbirds would appear to be the result of temporary turbidity, temporary loss of prey source, and potential impacts to intertidal organisms from drift

of suspended dredged material. Turbidity limits visibility and makes feeding difficult, if not impossible. Turbidity from dredged disposal activity, however, is localized and temporary. Furthermore, waterbirds will avoid the turbidity plume and feed elsewhere. Benthic resources at the disposal site are generally not utilized as food by waterbirds. Few birds dive 120 feet deep (cormorants and loons may), which limits the impacts to a few species. Furthermore, stomach samples of deep-diving birds indicate that bottomfish comprise only a small proportion of the total diet. Thus, these birds do not depend on bottom-living organisms, and, in fact, primarily utilize free swimming fish such as herring and smelt.

Even if the disposal areas were utilized by waterbirds and the sites did not fully recolonize, the total area of impact is small relative to the potential feeding area in Puget Sound. Waterbirds are mobile; also, the site has relatively low biological productivity to begin with, such that the loss would be minimal. The potential loss of intertidal organisms from drift of suspended material is considered to be minimal and would not affect waterbirds.

The selected disposal site is not presently nor historically an area of concentration of waterbirds. Port Gardner's primary value to waterbirds is in the protected intertidal areas, where most of the waterbird species can find refuge and a food resource. Significant impacts could be expected to shorebirds if nearshore areas were developed as confined disposal sites.

(b) Terrestrial Birds. For material requiring confined disposal, terrestrial birds could be significantly impacted under the preferred alternative depending on the types of upland habitat used for construction of confined disposal sites. Impacts would be greater if forested land were used relative to cleared land because of the greater diversity of birds associated with the former. Following reclamation of the area after the life of the disposal site, sublethal chronic impacts to terrestrial birds could occur due to ingestion of plants and animals that have accumulated contaminants arising from the dredged material.

(7) Marine Mammals. No significant long-term impacts to marine mammals indigeneous to or migrating through Port Gardner are expected from disposal of dredged material at the selected site. No marine mammals discussed in section 3 are abundant in Port Gardner, and their presence in the selected disposal site would only be a rare occurence. It is therefore probable that no significant physical or chemical impacts to marine mammals are expected. Those mammals in the vicinity of the disposal site during a disposal operation, would likely avoid the area during the dumping activity. Marine mammals feeding on bottom fish and macroinvertebrates in the vicinity of the disposal site may accumulate small levels of chemicals concentrated in their prey, although the amount attributable to the disposal site itself would probably not be significant due to their wide ranging foraging habits and the small percentage of site use (Wright, 1978).

(8) Endangered and Threatened Species. Biological assessments have been prepared that evaluate potential impacts to bald eagles, gray whales, and humpback whales (exhibit A). The only species on the Federal list that are

found in Puget Sound are the gray whale, humpback whale, peregrine falcon, and bald eagle. Gray whales are regularly, though infrequently, sighted in Puget Sound. These are considered stragglers which may or may not feed while in Puget Sound. Some of the few recent sightings of gray whales in Puget Sound have been relatively close to the preferred disposal site. In each case, the whales were present for no more than 1 day and were not seen again in the same area. The implication is that the whales are "passing through" (and in all likelihood not feeding) and find no special attraction for any one area. It thus appears that selection of the proposed disposal areas would not impact gray whales, regardless of the sites ultimately selected. Much the same arguments can be made for humpback whales.

Peregrine falcons are rarely observed in the vicinity of any of the selected disposal areas; rarely enough, in fact, that the U.S. Fish and Wildlife Service did not include this species on its list of species that should be considered in the biological assessment. Their prey base consists of small waterbirds, primarily ducks such as teal, and shorebirds. Peregrines prefer to stoop on large flocks of such birds, where they have greater odds of finding one that is weak or confused and, hence, easy prey. Such flocks are most often in protected bays in intertidal or shallow subtidal habitats. The open-water disposal site is relatively unprotected and generally does not attract large numbers of waterbirds. The lack of such large flocks at the proposed disposal area suggests that selection of the site would not impact peregrines (since their prey base would not be affected).

Bald eagles are present throughout the year near the selected disposal site. They feed on whatever may be present (ducks, gulls, live surface-swimming fish, dead animals washed ashore, etc.). Again, concentrations of birds or fish are helpful for prey-capture success. The selected disposal site for Port Gardner does not have large concentrations of animals and thus feeding by bald eagles would not be affected.

Other potential affects associated with the disposal site include primarily human disturbance and noise from disposal barges. The most important consideration is that the selected site is not near regular areas of animal use. Thus, human disturbance and noise are not expected to affect any endangered species.

c. Impacts and Their Significance to Human Environment.

(1) Social Economic. Adverse impacts to waterborne commerce movements in Port Gardner and vicinity, and related port terminal and industrial development are expected to be substantially less with this alternative relative to the No Action alternative. Because of higher costs associated with dredging and dredged material disposal, dredging cycles may be extended over that experienced in the past. However, delays would be less under this alternative than those expected if Site Condition I were chosen for management of the unconfined, open-water disposal sites. The Dredging and Disposal Activity section (see below) presents a comparative analysis of the costs associated with dredging under the alternatives considered by PSDDA.

Impacts to sport fishing could also occur due to displacement by tugs and barges at the disposal site (see Navigation section below). In addition, impacts to land and beach use could also be expected if nearshore and upland disposal sites were developed in recreational areas. Overall, social economic impacts are not expected to be significant.

(2) Transportation.

(a) Navigation. Normal average annual dredged material disposal activity in Port Gardner is expected to be 30 to 35 days per year, more than the level experienced over the past 15 years. Disposal activity could be considerably greater if the Upper Snohomish River channel dredged material is taken to the Port Gardner open-water site. Actual activity would depend on dredging projects undertaken, and the results of chemical and biological tests performed on material to be dredged. As navigation channels would be maintained, there would be no adverse impacts on navigation activity due to channel shoaling. Barge-tug movement during disposal operations is not expected to be much different than at present and consequently there should be no significent navigation conflicts with commercial or pleasure craft.

Since disposal typically is accompanied by dredging, the Port Gardner selected site would not be used during the salmon and steelhead smolt outmigration window: March 15 through June 15. During times of normal site use, disposal activity at the site would be expected to average about 2 to 3 barges per day with peak activity of 5 barges per day (table 4.9).

When proceeding to the disposal site, tug and barge combinations move at a slower rate loaded than unloaded. Average travel speed is typically around 5 knots. Once on site, disposal operations within the 1,800-foot diameter disposal zone usually require between 5 and 10 minutes. On occasion, weather constraints and repositioning requirements (to ensure proper location of disposal) can increase the onsite time to as much as 20 minutes. Using an average of 10 minutes, and assuming two to three barges per day, normal site time would amount to about 20 to 30 minutes per day or about 15 hours per year.

Though delays in disposal activities could result from avoiding conflicts with tribal fisheries (see below), they are unlikely, given the anticipated and required coordination between dredgers and the tribes.

Disposal operations at the selected site would represent a slight increase in navigation traffic for the site proper. With increased water traffic, there is an increase in risk of minor oil leaks or spills, and of vessel collisions. The location of the disposal site, infrequent site use, and the short duration of site occupancy indicate that these risks are not significant and are likely not measurable.

(b) Land. Impacts to land transportation would be considerably less than those resulting from the no-action alternative, as 95 percent of future dredged material is expected to be found suitable to be placed in the Port Gardner disposal site. Truck hauls and traffic congestion associated

with upland disposal would be substantially less than under the No Action alternative, where most dredged material would be placed in nearshore or upland sites.

(3) Dredging and Disposal Activity. The overall impact of this alternative on dredging activity in Port Gardner would be to increase the volume of material found acceptable for unconfined, open-water disposal over that allowable under existing interim criteria. Currently, the suitability of material for open-water disposal in Port Gardner is based on the Port Gardner Interim Criteria. However, these interim criteria are essentially identical to the Puget Sound Interim Criteria (PSIC). Using PSIC, only about 14 percent of the future Port Gardner area material is expected to be suitable for unconfined, open-water disposal. Under the selected site management condition, 4.6 million c.y. of material is projected over the next 15 years to be found acceptable for unconfined, open-water disposal at the Port Gardner site (table 4.2c). Actual disposal volumes would depend upon the outcome of chemical and biological tests conducted on the material and the actual projects proposed for dredging. Costs of dredging (including testing, dredging, disposal, compliance inspections, and open-water site monitoring costs) over the next 15 years in Port Gardner using Site Condition II would be approximately $19.1 million (table 4.6). Assumptions and details calculations used in deriving these estimates are described in EPTA (part II, section 10). It is anticipated that as source control improves and project-specific experience and data become available, the portion of future dredged material that is acceptable for unconfined, open-water disposal would increase.

(4) Native American Fishing. The selected alternative is not expected to significantly impact Native American fishing in Port Gardner. As described in section 2, steps have been outlined to ensure that disposal-related vessel traffic would be compatible with tribal fishing.

Disposal operations are not expected to affect salmonids in Port Gardner. The disposal site is situated in water greater than 200 feet deep and salmonids feed at shallower depths. Adult salmon and steelhead trout migrating through the disposal site should not be impacted by disposal operations as the majority of the fish would avoid disposal-related turbidity plumes. The few fish that may pass through the plume may be stressed to a minor degree. However, this disturbance would be short duration and would not have any long-term effect on the health of the fish. The sea surface microlayer is also not expected to significantly impact salmonids or to have an effect on fishing gear. Contributions of dredged material to the sea surface microlayer have not been quantified, but are not considered significant relative to other probable sources from permitted discharges. Adult salmon may occasionally swim at the surface for short periods (during milling behavior), but contact with sea surface microlayer chemicals would not affect the physiological health on marketability of the fish. The microlayer is not thought to be continuous on the sea surface, and appears to be easily disrupted; therefore, contamination of fishing gear and nets from the sea surface microlayer near the disposal site would not be significant.

(5) Non-Indian Commerical and Recreational Fishing. Non-Indian fishing activities may be displaced during the discharge of dredged material at the selected disposal site. At times of normal dredging activity, this displacement could persist for 5-10 minutes, up to five times per day. The selected disposal site has been located to minimize potential conflicts with known commercial and sports fishing activities. It is anticipated that displacements, if they occur at all, are more probable for sports fishermen than for commercial activities. The disposal site location and the relatively short duration of site use, are expected to preclude any significant adverse effects to fishing activities and catch success in these waters.

(6) Human Health.

(a) Via Seafood Consumption. No impact on human health is anticipated from the consumption of seafood that might be in or near the disposal site. Only suitable dredged material will be allowed for disposal at the site. No significant impact to human health is expected with Site Condition II.

(b) Via Drinking Water. When marine/brackish, dredged material is placed in a confined nearshore or upland disposal facility, the potential exists to generate leachates having adverse impacts on ground water and surface water used for drinking. Under this alternative, material forecasted to be found unsuitable for unconfined, open-water disposal will have to be placed in a confined site. If any material is placed in a nearshore or upland facility then potential for drinking water chemical impacts exists, especially if design features such as leachate collection systems, effluent control, or runoff control are not used or fail. Development of any upland or nearshore disposal sites, and the types of material allowed in these sites, would be subject to State and Federal regulations designed to protect drinking water sources. The relative potential for ground water chemical impacts under this alternative is less than the impacts that would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites and greater than the impacts if Site Condition III had been chosen.

(c) Via Inhalation of Dust. Dredged material placed on nearshore and upland disposal sites provides a potential source of dust with chemicals of concern that could have an impact on workers and residents living around such a site. Dust production can especially be of concern at multiuser sites where the deposited dredged material is being reworked. This can also be the case at a disposal site that is being prepared for alternate uses. The impacts to human health from inhalation of dust can be minimized by the application of suitable ground cover. The relative potential for dust production under this alternative is less than would be predicted if Site Condition I had been chosen for the unconfined, open-water disposal sites, and is greater than if Site Condition III had been chosen.

(d) Via Direct Exposure. Little direct exposure of humans to contaminated dredged material occurs. The only segment of the population that might be expected to come into direct contact with dredged material are workers on dredging crews and at upland and nearshore disposal facilities.

Material that is highly contaminated could be placed in secure disposal sites where protection against exposure to chemicals would be minimized by operational procedures (i.e., wearing protective clothing and respirator, security to limit access to the site, application of coverage soil for disposal).

(7) Noise. There have been no measurements of ambient noise levels or of the actual noise at the shore which would be produced by disposal equipment operating at the Port Gardner site. However, noise studies have been done at the shore adjacent to the Fourmile Rock disposal site in Elliott Bay that provide some estimation of the noise impact of disposal operations.

Between 20 September 1985 and 24 June 1986, eight separate noise studies were conducted in the residential area near the Fourmile Rock site by two noise consultants. Ambient noise measured between 35 and 70 dBA and averaged from 35 to 51 dBA during the different measuring periods. Noise from tugs and tug-barge combinations was measured at between 37 and 46 dBA. The average noise levels were in the low 40's. The exception was one barge which measures 58 dBA for a short time. Muffling has since been added to bring the noise level down further. In a number of cases, the noise testers reported that the tugs and barges could not be heard above ambient noise at the shore.

The selected Port Gardner site will be at least 2,500 feet from the Port Gardner shoreline. It is assumed that noise impacts from use of the site will be well within State and Federal noise standards and, in many cases, unnoticeable.

(8) Esthetics. Disposal operations are not expected to significantly affect the esthetic quality or experience in Port Gardner Bay and vicinity. The disposal operations would be further removed from the harbor area than in the case of Elliott or Commencement Bays. Viewers from the various shoreline, downtown, and bluff areas identified in section 3 will see the occasional presence (between one and five times daily during dredging operations) of a tug and barge moving into the inner bay area, spending about 5 to 10 minutes for disposal, and leaving the area. The tug and barge will be most noticeable from the Everett shoreline, from high-rise office buildings, and from bluff areas in the south Everett vicinity. Viewers in these areas will probably not be able to discern the localized turbidity plume in the vicinity of the barge immediately following disposal, due to the distances involved between viewers and the disposal area. Although the sight of a tug and barge may not be a positive esthetic experience to some viewers, other viewers will perceive the tug and barge activity in a positive sense, considering it as an integral part of normal marine activities in Port Gardner, and not detracting from the overall view experience.

(9) Historic Impacts. As part of the disposal site identification mapping studies, a literature search was undertaken to establish if any historically significant shipwrecks were located within the Port Gardner selected and alternative disposal sites (see DSSTA). Also, additional literature reviews and sidescan sonar studies were made of the selected site in March 1988, confirming the earlier review. Further coordination was and is being accomplished with the State of Washington Office of Archaeology and Historic Preservation (see FEIS exhibits C and D).

d. Cumulative Impacts. In Port Gardner, once disposal commences at the selected site, a slightly larger area of the bottom of Port Gardner Bay would be disturbed and its productivity altered. Discontinued use of the existing DNR site should have beneficial effects for area resources in the long-term. The site would continue to be covered over with sediment from the Snohomish River and should provide good habitat for establishment of a climax benthic community that should not be significantly impeded by chemicals in dredged material previously disposed of there. The existing DNR site is located within the Port Gardner Dungeness crab and bottom fish high-use area (see section 3). Closure of this site would halt the disruptions to these resources.

Within the selected disposal site dilution zone, during and immediately after disposal, production would be reduced and sublethal/chronic impacts are possible for benthos directly exposed to the dredged material. Upward migration by several species of polychaetes and molluscs through the newly placed material, and immigration from adjacent areas by crustaceans and larvae of polychaetes and molluscs would result in pulsed benthic production, during nondisposal "windows." The significance of these impacts can be estimated as a function of percentages of the local sessile populations affected by each disposal and of the percentages of the forage base for mobile species that the proposed site represents. Overall, it is estimated that sediments at the preferred site would have higher chemical levels than existing sediments, potentially resulting in altered benthic community structure at the site and slight changes in benthic productivity.

A disposal operation that would also contribute to cumulative physical/chemical modification of deep benthic habitat in Port Gardner is the disposal of dredged sediments from East Waterway by the U.S. Navy as part of their Everett Homeport facility. Contaminated and uncontaminated dredged material from that project, totaling about 3.3 million c.y., would be deposited at the proposed Confined Aquatic Disposal (CAD) site located just north of the existing DNR site and extending over an area of 380 acres. The contaminated material would be capped with uncontaminated material. The CAD site is not located in the high use Dungeness crab or shrimp area. The capping operations would be conducted in two phases, with the second phase commencing aproximately 8 months after the first phase. Benthic production from the site would be marginal during the 8-month no disposal period, but following the second phase, benthic colonization would again commence, and in a few years a stable benthic community would be expected. This assumes that the CAD operation effectively isolates the contaminated sediments from the cap and water column. This also assumes that contaminants would not significantly bioaccumulate in the benthos through contact with the small quantity of contaminated material that would be released during disposal to perhaps accumulate in the nepheloid layer, or through contact with the contaminated layer because of bioturbation activities.

The cumulative effects of disposing at the preferred PSDDA site, of successfully disposing at the proposed Navy CAD site, and of not disposing further at

the existing DNR site is expected to be no net reduction in Port Gardner deep-water benthic production and no significant impacts on Port Gardner biological resources.

e. Relationship to Existing Plans, Policies, and Controls.

(1) Clean Water Act, Sections 404/401. Procedures used in identifying the selected Port Gardner disposal site and site management condition are consistent with the 404(b)(1) Guidelines for Specification of Discharge Sites for Dredged or Fill Material (40 CFR Part 230). Federal advance identification of the selected site as suitable for disposal of dredged material pursuant to part 230.80 of the Guidelines is addressed in exhibit B. The selected site and site management condition are also consistent with Ecology guidelines for State water quality certification pursuant to Section 401 of the CWA.

(2) Coastal Zone Management. The Coastal Zone Management Act (CZMA) (Public Law 91-583: 86 Stat. 1280) was passed by the United States Congress in 1972. In June 1976, the State of Washington Coastal Zone Management Program (CZMP) was approved to receive funding allowing the CZMA to be implemented via the State Shoreline Managment Act (SMA) of 1971. As passed by the State legislature, the SMA provides "for the management of Washington's shorelines by planning and fostering all reasonable and appropriate uses." The SMA is implemented through detailed planning efforts that culminated in the Shoreline Master Programs (SMP) for the large municipalities and counties of the State. The selected alternative is consistent with the SMA and the current State CZMP, satisfying consistency with State and Federal coastal zone management requirements.

(3) City of Everett Shoreline Master Program. The selected disposal site is located within the jurisdiction of the city of Everett, which adopted its shoreline master program in 1986. The site lies within the shoreline environment classified as urban. Dredged material open-water disposal is listed as a permitted or conditional use. The selected alternative is consistent with the city's master program as presently written.

(4) Department of Natural Resources (DNR) Policy on Open-Water Disposal of Dredged Material into Puget Sound. Sites throughout the Puget Sound area have been designated by DNR for open-water disposal. If the dredged material cannot be beneficially utilized (e.g., creation of artificial islands, landfill), and it is approved by all of the various regulatory agencies for open-water disposal, it can be deposited in one of the DNR sites. Fees and lesses from DNR and permits from other agencies are all required before disposal of dredged material can occur. The selected Port Gardner site will be an approved DNR open-water disposal site once the local shoreline permit has been granted by the city of Everett.

(5) Executive Order 11990, Protection of Wetlands. The intent of Executive Order 11990 is to protect wetlands because of the significant cumulative losses that have occurred, and due to their high value to biological

productivity and their many other critical functions. As the selected Port Gardner site lies in water over 400 feet deep, no wetlands would be directly affected. Dredging projects which could affect wetlands would be evaluatated on a project by project basis at the time the project is reviewed for permits under Section 404 of the CWA.

(6) Executive Order 11988, Flood Plain Management. The intent of Executive Order 11988 is to provide guidance and regulation for projects located in, and affecting, the flood plain. Executive Order 11988 requires, to the extent possible, avoidance of long- and short-term adverse impacts associated with occupancy and modification of flood plains.

As the selected open-water disposal site lies in water over 400 feet deep, no direct flood plain impacts would be involved by use of the site. Dredging projects which could affect the flood plain would be evaluated on a project by project basis at the time the projects are reviewed for permits under Section 404 of the CWA.

(7) Puget Sound Water Quality Comprehensive Plan. The Puget Sound Water Quality Comprehensive Plan was adopted 17 December 1986. The contaminated sediment and dredging program of the plan contains a sediment program goal "to reduce and ultimately eliminate adverse effects on biological resources and humans from sediment contamination throughout the Sound by reducing or eliminating discharges of toxic contaminants and by capping, treating, or removing contaminated sediments." The plan also adopts the following policies which shall be followed by all State and local agencies in actions affecting sediment quality, including rulemaking, setting priorities for funding and actions, and developing permit programs:

> "All government actions will lead toward eliminating the presence of sediments in the Puget Sound basin that cause observable adverse effects to biological resources or pose a serious health risk to humans."
>
> "Programs for management of dredging and disposal of sediments should result in a net reduction in the exposure of organisms to adverse effects. (The intent of this policy is that dredging and disposal contribute to the cleanup of the Sound by allowing unconfined, open-water sites to have only low levels of contamination and to dispose of more contaminated sediments in a manner that prevents continued exposure of organisms to adverse effects. For proposals where dredging will expose contaminated sediments, project-specific mitigation measures may be required."
>
> "Remedial programs (which may include capping inplace) shall be undertaken when feasible to reduce, with the intent of eliminating, the exposure of aquatic organisms to sediments having adverse effects."

The selected sites are located to minimize the exposure of aquatic animals to dredged material placed at the unconfined site. The sites are relatively non-dispersive and are situated away from high abundances of important aquatic species and from human use areas of the Sound. Although the species potentially exposed to the dredged material at the disposal sites are different from those present at the dredging site, the net effect of the dredging and disposal action could be to reduce overall exposure potential by moving the material from shallow estuarine areas to deeper marine waters.

Per the definition of the selected site management condition, the material to be discharged at the unconfined, open-water sites is not expected to pose a serious risk to human health. Though the selected condition could potentially result in some "observable adverse effect" in the form of sublethal effects to any organisms that remain within the disposal site for an extended period of time, the discharge of substantially better (or "cleaner") material on the sites would likely result in an aggregate condition comparable to the stated plan policy.

The dredger does not typically control the original discharge of chemicals of concern into the aquatic environment. Nevertheless, the PSDDA study has highlighted the importance of the PSWQA goal relative to "reducing or eliminating discharges of toxic contaminants" into the Sound. As this goal would be achieved through improved source control, material dredged from the Sound's waterways should improve in quality, as should the condition at the disposal sites. Consequently, source control must remain a high priority for protection of the Sound.

For the reasons described above, the PSDDA selected alternative for Port Gardner is considered to be consistent with the 1987 Puget Sound Water Quality Comprehensive Plan.

(8) American Indian Religious Freedom Act. The American Indian Religious freedom Act of 1978 (AIRFA) requires Federal agencies to ensure that none of their actions interfere with the inherent right of individual Native Americans (including American Indians, Eskimos, Aleuts, and Native Hawaiians) to believe, express, and exercise their traditional religions. These rights include access to religious sites, use and possession of sacred objects, and the freedom to worship through traditional ceremonials and rites. The AIRFA requires coordination between Federal agencies and Native Americans to ensure that federally supported projects or projects on Federal land do not infringe on the religious practices of Native Americans.

Coordination between PSDDA agencies and potentially affected tribes has occurred throughout the study, and is an ongoing process.

4.14 Alternative PC2-II: Port Gardner Site 2 With Site Condition II. Many of the potential environmental effects of disposal of Site Condition II dredged material at the alternate site in Port Gardner (site 2) are similar to those of the preferred alternative (site 1). This is a direct result of the

site identification process: both sites are located in relatively nondispersive environments and are positioned to minimize disturbance to key bottom resources. Differences in their physical, biological and human environments, and consequent differences in environmental effects that would result by their use as dredged material disposal sites, are described below.

a. Impacts and Their Significance to the Physical Environment. Environmental consequences from disposal of acceptable (per Condition II) dredged material at the Port Gardner site 2 would be the same as those described for site 1 above for water quality, air quality and land. These resources, which are very similar at both sites 1 and 2, would not be significantly impacted by the use of site 2.

Data from the current meter studies indicate that site 2 has comparably low current velocities relative to site 1, such that deposited dredged material would stay onsite. However, existing sediments at the site are characterized as being coarser (with more fine and very fine sand, and less clay) than those at site 2. The existing dredged material disposal site in Port Gardner is located immediately to the south of site 2. The use of a new site to the north, which would likely contain very similar material to that currently found in the old site, would result in extending the modification of the bottom sediment type further to the north. These effects, however, are not considered significant.

b. Impacts and Their Significance to the Biological Environment. Environmental effects resulting from the disposal of acceptable (per Condition II) dredged material at site 2 in Port Gardner would be identical to those described for site 1 above for flora, anadromous fish, birds, marine mammals and threatened and endangered species. No significant differences exist between the two sites for these resources.

Available data indicate that adverse effects to benthic invertebrate species (polychaete worms, molluscs, and less mobile crustaceans) would be somewhat higher at site 2 than at site 1. This is reflected in the higher benthic biomass present at site 2 (61 g/m2) when compared to site 1 (36 g/m2). However, these observed differences are not statistically significant due to the high variability in the benthic communities at the sites. The Benthic Resource Assessment Technique (BRAT) confirmed these differences by noting that predators would see a slightly higher food value at site 2 when compared to site 1, but again not to the degree of statistically significant differences. Use of site 2 would result in the loss of these additional benthic resource values; however, for the reasons described for site 1 above, these losses are not considered significant.

Use of site 2 in Port Gardner could result in somewhat greater adverse effects to shrimp at the disposal site when compared to site 1. This is not due to the differences in the number of shrimp found at the two sites, but rather the locations of the sites relative to areas of the bay that contained high concentrations of shrimp. Site 2 is located immediately adjacent to high concentrations of shrimp when compared to the location of site 1 (within 0.5 nmi).

The relatively nondispersive characteristic of site 2 should prevent any significant adverse effects to these high concentration areas of shrimp. Though neither site contained large numbers of shrimp, differences between the sites varied by season. The differences were most prominent during February, when site 2 contained more shrimp (82-355/ha) than site 1 (0-135/ha). In April, site 2 contained fewer shrimp (13-38/ha) than the preferred site (63-24/ha). In June, site 2 again contained more shrimp than site 1 (0-117/ha versus 6-80/ha, respectively). And in September, the preferred site again had more shrimp than site 2 (32-101/ha versus 6-86/ha). As with site 1, the use of site 2 for dredged material disposal would result in burial or displacement of those shrimp found in the site during disposal operations. Surviving or returning individuals could experience minor, sublethal adverse effects due to chemical concentrations present in the material on site, as long as they remain onsite for a prolonged period of time and are not buried or displaced by further disposal activity. To the extent that the surrounding environment is at carrying capacity for these species, the displaced shrimp may experience reduced survival on a population basis. The abundance of shrimp found on site 2 is considered to be very low when compared to numbers found in shallower waters or in harvested areas of the Sound. As a result, adverse effects to shrimp populations of the area due to this alternative are not considered to be significant.

There were few Dungeness crabs found in either site 1 or 2; however, as with shrimp, site 2 is located immedately adjacent to areas with high concentrations of crabs compared to site 1 (0.5 nmi). Compared to site 1, site 2 had measurably more crabs on site during February, April and June samplings, and fewer crabs during the September sampling. Site 1 had an average of 0, 0, 0 and 39 crabs per hectare during February, April, June and September; site 2 had "few," 19, 0 and 19 per ha. during the same seasons. As with site 1, the use of site 2 for dredged material disposal would result in burial or displacement of those crabs found in the site during disposal operations. Surviving or returning individuals could experience minor, sublethal adverse effects due to chemical concentrations present in the material on site, as long as they remain on site for a prolonged period of time and are not buried or displaced by further disposal activity. To the extent that the surrounding environment is at carrying capacity for these species, the displaced crabs may experience reduced survival on a population basis. The abundance of crabs found on site 2 is considered to be very low when compared to numbers found in shallower waters or in harvested areas of the Sound. As a result, adverse effects to crab populations of the area due to this alternative are not considered to be significant.

Bottom fish at site 2 are more abundant than those found at site 1, likely due to the site's proximity to shore and slightly shallower waters. With identical abundance (400/ha) at the two sites during the February time, bottom fish at site 2 were more abundant during April (103/ha) and June (156/ha) relative to site 1 (68 and 60/ha, respectively). As with site 1, given the overall low numbers of bottom fish at the site relative to shallower waters, the impacts to these species resulting from the disposal of dredged material at site 2 are not considered significant.

c. Impacts and Their Significance to the Human Environment. Use of the Port Gardner site 2 with Site Condition II would result in the same environmental effects as those described for site 1 for social economic values, transportation, human health, and noise qualities. Consequences to these resources, identical for both sites, would not be significant.

Relative to dredging and disposal activity, site 2 is located such that the site would overlap the preferred confined aquatic disposal site for dredged materials to be derived from the U.S. Navy Homeport project. Should the Navy proceed under its current schedule, the designation of a multiuser disposal site at this location (via PSDDA) would require additional coordination to avoid site use conflicts during construction of the Navy project. Additionally, normal disposal operations may be precluded during certain phases of the Navy construction. Monitoring operations following disposal would require further effort to adequately distinguish between the effects of the two projects. In general, the two projects are compatible, but detailed coordination between PSDDA and the Navy would be needed to avoid adverse effects to site use and environmental monitoring.

Site 2 would be located closer to shoreline efforts of Native American fishermen than site 1. However, since site 2 is sufficiently removed from the shore, no conflicts with the fisheries should result. Coordination between fishing and dredging activities would be required to avoid these conflicts. Overall, use of site 2 for dredged material disposal would not result in significant adverse impacts to Native American fishing.

The presence of a public recreational beach near site 2 presents the potential for adverse effects to occur relative to reduced esthetic quality of the area. These effects are associated with tug and barge activities during disposal operations, related disruption of the visual esthetics of the area as seen from shore, and the potential presence of a visible turbidity plume. The degree of these effects would be less than those experienced by the area with use of the existing disposal site in Port Gardner, located closer to shore than site 2. The intermittent use of the site, the presence of numerous other navigation-related activities in the area, and the short-term persistence of these adverse effects all indicate that while adverse effects to esthetic qualities would be more measurable and noticeable than at site 1, they are not expected to be significant for this alternative.

4.15 Alternative PG3-II: Port Gardner Site 3 With Site Condition II. Many of the potential environmental effects of disposal of Site Condition II dredged material at the other alternate site for Port Gardner (site 3, Saratoga Passage) are similar to those of the preferred alternative (site 1). This is a direct result of the site identification process: both sites are located in relatively nondispersive environments and are positioned to minimize disturbance to key bottom resources. Differences in their physical, biological and human environments, and consequent differences in environmental effects that would result by their use as dredged material disposal sites, are described below. (Though located in Saratoga Passage, site 3 is referred to here as a Port Gardner alternative site.)

a. Impacts and Their Significance to the Physical Environment. Environmental consequences from disposal of acceptable (per Site Condition II) dredged material at the Port Gardner site 3 would be the same as those described for site 1 above for water quality, marine and estuarine sediments, air quality and land use. These resources, which are very similar at both site 1 and 3, would not be significantly impacted by the use of site 3.

b. Impacts and Their Significance to the Biological Environment. Environmental effects resulting from the disposal of acceptable (per Site Condition II) dredged material at site 3 in Port Gardner would be identical to those described for Site 1 above for flora, crabs, anadromous fish, and marine mammals. No significant differences exist between the two sites for these resources.

Available data indicate that adverse effects to benthic invertebrate species (polychaete worms, molluscs, and less mobile crustaceans) would be somewhat lower at site 3 than at site 1. This is reflected in the lower benthic biomass present at site 3 (7 g/m2) when compared to site 1 (36 g/m2). Additionally, these statistically significant differences are reflected in the Benthic Resource Assessment Technique (BRAT) which noted that predators would see a lower food value at site 3 (2.6-7.2 g/m2) when compared to site 1 (12.3-19.6 g/m2). Though use of site 3 would result in the loss of these benthic resource values, for the reasons described for site 1 above, these losses are not considered significant.

Use of site 3 in Port Gardner would result in somewhat greater adverse effects to shrimp at the disposal site when compared to site 1. This is due to the differences in the number of shrimp found at the two sites. Though neither site contained large numbers of shrimp, differences between the sites were observed both in February and June. In February, site 3 contained measurable numbers of shrimp (50/ha) while the preferred site had none. In June, site 3 again contained more shrimp than site 1 (62.4/ha versus 6/ha, respectively). As with site 1, the use of site 3 for dredged material disposal would result in burial or displacement of those shrimp found in the site during disposal operations. Surviving or returning individuals could experience minor, sublethal adverse effects due to chemical concentrations present in the material onsite, as long as they remain on site for a prolonged period of time and are not buried or displaced by further disposal activity. To the extent that the surrounding environment is at carrying capacity for these species, the displaced shrimp may experience reduced survival on a population basis. The abundance of shrimp found on site 3 is considered to be very low when compared to numbers found in shallower waters or in harvested areas of the Sound. As a result, adverse effects to shrimp populations of the area due to this alternative are not considered to be significant.

Existing data indicate that bottomfish at site 3 are less abundant than those found at site 1. Given the overall low numbers of bottomfish at the site relative to shallower waters, the impacts to these species resulting from the disposal of Site Condition II at site 3 are not considered significant.

Site 3 is located closer to known spawning grounds of hake than site 1. These grounds support a fish that is important as prey for many species of birds, including many waterbirds and possibly the threatened bald eagle. For waterbirds, fish are their primary food source in deepwater and are known to frequently use hake fish as prey. While there is little direct evidence of bald eagles' use of hake, it has been observed that they catch them occasionally. However, bald eagles are not thought to feed on hake frequently enough that their loss from the eagle's diet would result in adverse effects to this species. The use of site 3 for the disposal of dredged material is not expected to significantly affect the hake spawning grounds. Consequently, adverse effects to water birds and threatened and endangered species are also not expected to be significant.

c. Impacts and Their Significance to the Human Environment. Use of the Port Gardner site 3 with acceptable (per Site Condition II) dredged material would result in the same environmental effects as those described for site 1 for transportation, Native American fishing, human health, noise and esthetic qualities. Consequences to these resources, which would be the same for both sites, are not considered significant.

Site 3 is located at a substantial additional distance from major dredging areas compared to site 1. This distance, an additional 8 nautical miles from the East Waterway of Port Gardner, could result in added transportation costs to dredged material headed to the unconfined, open-water site. These costs could amount to as much as an additional $0.64 per c.y. ($0.88 for site 3 versus $0.24 for site 1) of dredged material for site 3 relative to site 1. Whether these costs would actually be incurred depends on how the dredging is conducted, as the efficiency of the operation is the key factor. For dredging operations using the standard equipment of one tug and two barges, with a clamshell dredge operating at 1 or 2 bargeloads per day, it is possible to occupy the dredge without interruption due to transport of the dredged material. The transportation cost increases with this operation would be somewhat less than those incurred by dredging operations that require greater production rates or have less equipment.

Site 3 is located closer to known and proposed aquaculture sites than site 1. Given the nature of the material that would be deposited there, and the intermittent, localized and short-term effects that disposal would have on the water column, significant adverse effects to these aquaculture facilities are not anticipated. However, the proximity to these facilities would likely require some added effort in site monitoring to ensure that adverse effects did not occur.

4.16 Alternative PG1-I: Port Gardner Site 1 With Site Condition I. Analysis of the environmental consequences of the Site Condition I alternative for Port Gardner is provided here in comparison to the effects of the preferred alternative (Site Condition II). In general, the adverse effects of these two alternatives are similar in type, differing primarily in degree of effect in the various disposal environments. Substantially less material would be found acceptable for unconfined open-water disposal for Site Condition I than for

the preferred alternative. This would result in fewer or decreased adverse effects in the aquatic environment, and additional or increased adverse effects in the land and shore environments.

Though this alternative would result in less material placed at the unconfined open-water site, the spread of the material would cover a comparable bottom area at the site; however, the depth of cover would be less. Consequently, differences between Site Condition I and Site Condition II in physical impacts to site species would not be significant. The major differences between Site Condition I and Site Condition II would result from the different levels of biological effects permitted due to chemicals in the dredged material.

In Port Gardner, application of Site Condition I would result in substantially less volume (2,212,000 c.y.) of material acceptable for unconfined, open-water disposal in the next 15 years than for Site Condition II (4,684,000).

The following subsections describe the differences in environmental consequences that would result from the application of Site Condition I compared to those incurred by use of Site Condition II.

a. Impacts and Their Significance to the Physical Environment. Site Condition I would shift the primary water quality effects to nearshore, ground water and freshwater areas, with far fewer effects at the aquatic site compared to Site Condition II. A greater potential for chemical impacts to ground water and surface water is possible under this alternative compared to the preferred alternative, especially if design features are not used, or fail. As with Site Condition II, the effects at the unconfined site are intermittent and short term, and are not considered significant.

Compared to Site Condition II, Site Condition I would result in minimally different physical effects and modifications of marine sediments at the unconfined site due to the similar spread and distribution of the dredged material. Under this alternative, an increase over present concentrations in sediment chemicals would be expected at the disposal site. However, due to lower chemical concentrations in the dredged material, Site Condition I would result in fewer adverse effects within the unconfined site than Site Condition II. On balance, the potential for technological control (more material would be placed in upland and nearshore sites where control technology can be more easily applied) provides the opportunity for Site Condition I to result in overall fewer adverse effects to sediment quality than with Site Condition II.

Fewer barges utilizing the unconfined site means that fewer adverse effects to air quality would result at the site. However, the transport of the material via more trucks would mean a shift of air quality impacts to the land/shore environments, in closer proximity to human use. Overall, the adverse effects of Site Condition I to air quality are considered more substantive than those of Site Condition II. Though they would vary by the site being used, they are not likely to be significant.

For the dredged material that is not acceptable for unconfined, open-water disposal under the Site Condition I option, an estimated 101 acres of land and shore habitats (see table 4.3) could be impacted in the Fort Gardner area. When the total estimated water and land/shore acreages are combined for each alternative, Site Condition I would result in more land (419 acres) committed than Site Condition II (328 total acres). The overall significance of Site Condition I effects to land compared to Site Condition II would depend on the relative value ascribed to the aquatic and land/shore acreages.

b. Impacts and Their Significance to the Biological Environment. Site Condition I would result in fewer effects to aquatic flora at the unconfined site because a smaller volume of material would be discharged at the site and that this would have less potential for chemical effects. On land and near-shore environments, however, an increase in impacts to plants is possible. This is due to both an increase in acreage needed for disposal (loss of natural habitat) and placement of a greater volume of sediment with chemicals of concern in these environments. Overall, Site Condition I would result greater adverse effects to flora than for Site Condition II because of the added impact to plants under Site Condition I.

For invertebrates, the adverse physical effects of Site Condition I would be similar at the unconfined, open-water site as those of Site Condition II, though added physical losses of intertidal and subtidal shore- line habitat would occur.

Site Condition I results in fewer adverse effects to invertebrates than Site Condition II.

Aquatic marine fauna at the disposal site would be at less risk with Site Condition I than with Site Condition II. However, increased potential loss of shoreline habitat could significantly effect salmonids. The overall significance of using to Site Condition I, compared to Site Condition II, depends on the relative value ascribed to these habitats and species.

As with the case for Site Condition II, minimal impacts to waterfowl are expected from the disposal of dredged material suitable for Condition I at the open-water disposal site. Because of the potential loss of additional important habitat on land under this alternative, there is a greater probability for adverse impacts to birds than with Site Condition II. The same situation exists for threatened and endangered species. Though the species at risk will differ in the water and land areas, direct loss of land habitat represents a greater risk to these protected animals than do the disturbances at the open water site.

c. Impacts and Their Significance to the Human Environment. Compared to Site Condition II, social economic impacts of Site Condition I would be primarily associated with greater land use issues and greater cost to navigation and marine-related industries. These would be associated with somewhat lesser risks to the aquatic site and greater risks to land and shore environments. In addition, truck transport of dredged material has the potential of

adversely affecting traffic in and around land/shore disposal sites. Again, the overall significance of these tradeoffs depends on socially ascribed values to the impacted resources.

In Port Gardner, the estimated volume of dredged material that would meet Site Condition I over the next 15 years is 2,212,000 c.y. (or 45 percent of the 4,943,000 c.y. forecasted for Port Gardner). Compared with activity expected if Site Condition II were adopted, the overall impact of Site Condition I on dredging activity would be to reduce, or at least delay, initiation of new projects and ongoing navigation maintenance cycles. The primary reason for the reductions or delays would be the increase in project costs associated with having to place dredged material exceeding Site Condition I at other disposal options. Additional delays would result during identification, designation, acquisition, and development of upland and nearshore disposal sites. Without considering the expenses associated with project delays, the added cost of Site Condition I in Port Gardner would be about $35 million (Condition I: $53,930,000; Condition II: $19,104,000).

Under this alternative, there would be less barge traffic at the open-water site, with fewer potential fishery conflicts and need to coordinate dredging activities. However, increased use of shoreline and land disposal sites could result in overall greater adverse effects to resources and areas of importance to tribal fisheries. In addition, barge traffic would persist to some nearshore sites. Given the low degree of potential conflict that would exist with the unconfined open-water site with any alternative, the increased effects on land and shore areas suggest that Site Condition I would result in more significant adverse effects to native american concerns than would Site Condition II.

No difference in effects to human health would result from seafood consumption. Given the conservative approach applied in defining the site management conditions, Site Condition I should result in less risk to human health via seafood consumption than Site Condition II due to overall less volume and lower chemical concentrations that would go the unconfined, open-water sites. For both alternative Conditions I and II, the adverse effects to human health are not expected to be significant.

Site Condition I would increase the potential for adverse effects to human health in the land and shore environments. Increased risk of drinking water chemical impacts would result at upland sites. Dust and direct exposure to the dredged material also represent concerns at land and shore sites. By proper technology control, it is possible to limit the primary exposure to individuals that must work on or around sites during dredged material discharge and site completion or modification. Though the actual risks and effects would be site specific, on balance, Site Condition I has the potential for greater adverse effects to human health than does Site Condition II.

Noise impacts at the open-water site would be fewer with Site Condition I, but there would be measurably more noise effects at land and shore sites. Overall, the adverse effects to noise resulting from Site Condition I are considered more significant than those of Site Condition II.

d. Cumulative Effects. The location of the disposal site in Port Gardner significantly contributes to the avoidance of direct and indirect adverse effects to important human and environmental resources. The reduced potential for chemical releases into Puget Sound waters during disposal operations that would result with Site Condition I relative to Site Condition II would --- offset the increased loss of land and nearshore habitat that would also occur. Though the consequences to land are site specific, given past disturbances of shoreline environments, the potential exists for significant cumulative effects to occur with nearshore disposal sites. Consequently, Site Condition I has the potential for greater cumulative effects to the environment than Site Condition II.

4.17 Alternative PG1-III: Port Gardner Site 1 With Site Conditon III. Analysis of the environmental consequences of the Site Condition III alternative for Port Gardner is provided here in comparison to the effects of the preferred alternative (Site Condition II). With Site Condition III, all dredged material is estimated to be acceptable for unconfined, open-water disposal in Port Gardner (4,943,000 c.y. of material forecasted for the next 15 years). This would result in greater adverse effects to the aquatic environment, and few, if any, adverse effects to the land and shore environments relative to Condition II.

Though this alternative would result in more material placed at the unconfined, open-water site, the spread of the material would cover a comparable bottom area at the site. Consequently, differences in physical impacts to site species for Site Condition III and Site Condition II would not be significant. The major differences between Site Condition III and Site Condition II would result from the different levels of biological effects permitted due to chemicals in the dredged material.

In Port Gardner, application of Site Condition III would result in more volume (4,943,000 c.y.) of material acceptable for unconfined, open-water disposal in the next 15 years than for Site Condition II (4,664,000 c.y.). The following subsections describe the differences in environmental consequences that would result from the application of Site Condition III compared to those incurred by use of Site Condition II.

a. Impacts and Their Significance to the Physical Environment. Compared to Site Condition II, Site Condition III would shift all water quality effects from nearshore, ground water and freshwater areas, to the aquatic site. Water quality at the open-water disposal site could experience overall greater adverse effects with the Site Condition III alternative. Potentially significant contributions to the sea surface microlayer and nepheloid layer may occur with Site Condition III. As with Site Condition II, however, the impacts to water quality at the unconfined site are expected to be intermittent and short term, and are not considered significant.

Compared to Site Condition II, Site Condition III would result in similar physical effects and modifications of marine sediments at the unconfined site due to the volume and grain size distribution of the material. This would

result in a similar spread and distribution of the dredged material. However, due to higher chemical concentrations allowed in the dredged material, Site Condition III would result in greater adverse effects at the unconfined site than Site Condition II. Sediment quality could be significantly altered by Site Condition III which could lead to unacceptable adverse effects on biological resources. On balance, the lack of technological control associated with unconfined, open-water disposal (relative to upland and nearshore disposal) provides the opportunity for Site Condition III to result in the potential for greater adverse effects to the environment than with Site Condition II.

More barges would utilize the unconfined site, however, the increase in barge traffic would not result in any change in impact to air quality at the open-water site. With a reduced need to transport material via trucks, a shift of adverse effects to air quality from the land/shore environments to the water environment could occur. Overall, the adverse effects of Site Condition III to air quality are considered less substantive for human health than those of Site Condition II. Though air quality would vary based on site-specific characteristics, they are not likely to be significant in most cases.

Since there is no dredged material that is unacceptable for unconfined, open-water disposal under the Site Condition III option, no land acreage (see table 4.3) would be lost due to use of land and shore habitats. When the total estimated water and land/shore acreages are combined for each alternative, Site Condition III would result in less land (318 acres) commitment than Site Condition II (328 total acres). The overall significance of Site Condition III effects to land compared to Site Condition II depend on the relative value ascribed to the aquatic and land/shore acreages.

b. Impacts and Their Significance to the Biological Environment. Site Condition III would result in more adverse effects to aquatic flora at the unconfined site, but would avoid adverse effects to plants and terrestrial animals in land and shore areas.

For invertebrates, adverse physical effects associated with Site Condition III would be the same as those of Site Condition II. Because of the higher concentration of chemicals in Site Condition III, a greater number of species would be expected to exhibit possible acute and chronic effects then those expected with Site Condition II. The most significant difference between Site Condition III and Site Condition II is that Site Condition III could impact the nepheloid layer, resulting in the transport of material offsite to areas of valuable biological resources. Crab and shrimp populations found in the area could also be impacted by disposal based on Site Condition III because of the greater concentration of chemicals, relative to Site Condition II.

For birds, terrestrial wildlife, and threatened and endangered species, there would be an overall reduction in impact associated with Site Condition III compared to Site Condition II. For aquatic species listed as threatened or endangered, risks would be higher; however, the area around the open-water sites are not utilized by these species.

c. Impacts and Their Significance to the Human Environment. Compared to Site Condition II, Site Condition III would avoid land use issues, as open-water disposal would be the primary method for disposal of dredged material.

In Port Gardner, the estimated volume of dredged material that would meet Site Condition III over the next 15 years is 4,943,000 c.y. Compared with activity expected if Site Condition II were adopted, no overall impact of Site Condition III on dredging activity would be expected. The cost of Site Condition III in Port Gardner would likely be $16,029,000 compared to $19,104,000 for Site Condition II.

With Site Condition III activity, there would be more barge traffic at the open water site, with a greater potential for fishery conflicts and need to coordinate dredging activities. However, the increase in volume of material that would be allowed at the open-water site, relative to Site Condition II, would not be great enough to expect a significant increase in barge traffic. Avoiding the use of shoreline and land disposal sites would result in avoiding the adverse effects to these resources and areas of importance to tribal fisheries. Given the low degree of potential conflict that would exist with the unconfined, open-water site with any alternative, the decreased effects on land and shore areas suggest that Site Condition III could result in less significant adverse effects to Native American fishing activities than would Site Condition II.

There would be no different effects to human health resulting from the seafood consumption route via Site Condition III. However, given scientific uncertainties in chemical effects, though conservative, it can still be said that Site Condition III would result in greater risk to human health via seafood consumption than Site Condition II due to overall less volume and lower chemical concentrations that would go the unconfined, open-water sites. For both alternative, the adverse effects to human health are not expected to be significant.

Site Condition III would significantly decrease the potential for adverse effects to human health in the land and shore environments. Overall risks to drinking water would be avoided as a result of avoiding use of upland sites. On balance, Site Condition III has the potential for lower adverse effects to human health than does Site Condition II.

Noise impacts at the open water site will be about the same as with Site Condition II, but noise effects at land and shore sites will be avoided. Overall, the adverse effects to noise resulting from Site Condition III are considered to be less than those of Site Condition II.

4.18 Selection of the Port Gardner Alternative. Of the alternatives considered for the Port Gardner area, including the No Action alternative, the selected alternative is alternative PG1-II: unconfined, open-water disposal site 1 and Site Condition II. Several factors, discussed below, are significant in the preference for this alternative.

All three sites meet two key site identification factors: (1) the site should be located in relatively nondispersive environments and (2) the site should be positioned to minimize disturbance to key biological resources. Of the three sites, site 1 was found to have an overall lower potential impact on biological resources and the human environment than would the other two sites.

Site 1 contains lower levels of benthic biomass than does site 2; the benthic biomass of site 3 is lower than site 1 or site 2. In addition, site 3 also contains lower concentrations of bottom fish than do either of the other two sites. Site 2 is closer to areas containing commercially important levels of shrimp and Dungeness crabs. Use of site 2 could put these resources at greater risk to impact from dredged material disposal. Site 3, on the other hand, contains greater numbers of shrimp than does site 1. Site 3 is also close to ecologically important spawning grounds for hake and use of the site could put these resources at greater risk than the other sites.

In addition to the differences in potential for impact to important biological resources at sites 2 and 3, site 2 is close to a public beach while site 3 is in an area being used for aquaculture. Site 1, on the other hand, is far removed from such areas. Finally, site 2 boundaries overlap the boundary of the Navy Homeport disposal site. Use of the area by both the Navy project and PSDDA would complicate monitoring efforts of the PSDDA site and could interfer with proposed capping operations by the Navy.

Within the selected site in Port Gardner (site 1), some effects to crabs due to displacement and possibly associated sublethal effects to the remaining or returning individuals may result. The density of crabs at this site, however, is somewhat lower than at site 2, and impacts to the crab population in Port Gardner are considered to be less if material is deposited at site 1 rather than at site 2.

The identification of a selected biological effects condition for site management is based on consideration of the overall environmental effects of the dredged material disposal program (including both aquatic and land/shore effects). In order to ensure consistency throughout the region, these assessments were made for the entire Phase I (central Puget Sound) area.

Dredged material discharged at the unconfined, open-water sites must be acceptable for maintaining the chosen site management condition. Under Site Condition II, dredged material deposited at Port Gardner site 1 is predicted not to have unacceptable adverse impacts on biological resources within or outside the disposal site, or to result in increased risks to human health. Impacts that do occur to aquatic organisms are expected to be confined to the disposal site and should not result in greater than sublethal chemical effects to the few remaining and more sensitive species within the zone (i.e. significant acute toxicity will not be present on site). A monitoring plan developed for the PSDDA disposal sites will be used to ensure that effects at the disposal site are within the Site Condition II limits and that offsite impacts are not occurring. If monitoring indicates impacts may be exceeding Site Condition II limits, appropriate site management response would be taken.

Site Condition I would reduce adverse effects to the aquatic environment relative to Site Condition II, but would relatively increase adverse effects to land and shore environments. Site Condition III, on the other hand, would result in much greater adverse effects to the aquatic environment then would either Site Condition I or Site Condition II with almost no impacts to land and shore environments.

Costs for testing, dredging, disposal, and monitoring of the volume of sediment that is forecasted to require removal over the next 15 years in the Port Gardner area under Site Condition I would be approximately $54 million, $35 million more than the costs of disposal under Site Condition II ($19 million). Site Condition III would result in approximately $16 million in dredged material costs, $3 million less than Condition II.

The selected alternative is consistent with Section 404 of the CWA which governs the discharge of dredged material in nearshore waters of the United States. Under Section 404(b)(1), no "unacceptable adverse effects" can result from the discharge of dredged material in open-water sites. Research and analysis of data used to define the alternative site conditions indicate that disposal of Site Condition II material should not result in unacceptable adverse effects on aquatic resources. The selected site management condition will, furthermore, not allow significant acute toxicity onsite; thus meeting State water quality standards and a condition frequently used in the implementation of Section 404 nationwide.

In considering the overall effects (total impacts of dredged material disposal) to land and water, the use of Site Condition II is considered the environmentally preferred approach and was therefore chosen. Additionally, alternative PG1-II, (site 1 and Site Condition II), most closely meets the stated PSDDA goal to provide for publicly acceptable guidelines governing environmentally safe unconfined disposal of dredged material in Puget Sound.

SECTION 5. SUMMARY OF PHASE I ENVIRONMENTAL CONSEQUENCES

5.01 Regional Perspective. This section of the EIS summarizes the environmental consequences of the alternatives evaluated in detail in section 4, in a way that emphasizes the regional perspective of the PSDDA study and the findings for the overall overall Phase I area.

5.02 Probable Adverse Environmental Effects Which Cannot Be Avoided.

a. Effects of Disposal: Selected Alternatives. The selected alternatives for the Phase I area include the use of site management condition II at the selected unconfined, open-water disposal sites located in Commencement Bay, Elliott Bay, and Port Gardner. As discussed in section 2, the same site management condition was selected for all sites in order to provide regional consistency. This recognizes the similar characteristics of the sites and avoids unnecessary complications in dredged material management.

(1) Air Quality and Noise. Localized reductions in air quality may occur in the vicinity of the selected unconfined, open-water disposal sites due to exhaust emissions from the internal combustion engines of the disposal equipment. Localized increases in noise levels would also occur during disposal operations. These adverse effects from noise, and to air quality, are expected to be short term, intermittent, and relatively buffered from other human uses, and are therefore not considered significant. Long-term or persistent adverse effects are not anticipated.

Minor volatilization of chemicals of concern during barge transport to the unconfined, open-water disposal sites can occur. For the dredged material that is discharged on land, the loss of sediment-associated chemicals to the air can be a more effective pathway than for material discharged in water. These losses would occur both during transport (e.g., truck haul) and after discharge on land. However, volatile chemicals of concern in dredged material are rarely sufficiently concentrated to result in measurable or significant releases to the air.

(2) Water and Sediment Quality. Temporary reductions in water quality would be permitted in the standard dilution zones established for each disposal site (see FEIS section 1 and the MPR, chapter 7). These zones would be designated in the water quality certification for each dredging project. The water quality reductions could include minor depression of dissolved oxygen, increases in turbidity, and some release of organic matter and sediment-associated chemicals of concern. These effects would be primarily associated with the disposal plume. Though they may be measurable throughout the water column, the effects would be most noticeable in the bottom layer, near the sediment/water interface (the nepheloid layer). Any releases of floatable particles (and associated chemicals) could be contributed to the sea-surface microlayer. Additionally, there is always some risk of incidental oil spills at the disposal sites associated with the disposal equipment. For dredged material found acceptable for unconfined, open-water disposal, these adverse effects to water quality would be minor and temporary, with rapid dilution or dispersion subsequent to disposal. In general, turbidity associated

with disposal operations is substantially less than that occurring due to riverine, high-water discharge periods, or from vessel passage in navigation channels (propeller action). Significant or unacceptable effects are not anticipated.

Environmental consequences from unacceptable sediment quality at the disposal sites have the potential to be persistent and long-term (assuming continued use). As measured by the potential of sediment chemicals to result in adverse biological effects, the quality of sediments may either decrease or increase at the disposal sites as a result of PSDDA. This would depend on the relative quality of site sediments to the discharged dredged material. As measured by effects on biological resources, the quality of sediments could remain unchanged or improve somewhat at the Elliott Bay selected site and possibly also at a portion of the Commencement Bay site. For the Port Gardner site, some decrease in sediment quality is anticipated, given the relatively undisturbed nature of this area. While sublethal adverse effects could occur within each disposal site, this is generally not anticipated. Because only acceptable sediments would be discharged at the disposal sites, the aggregate condition of each site is expected to be substantially better than allowed under the selected management condition (Site Condition II). Consequently, the net effect of site use on the existing sediment quality would probably be somewhat less than described for Port Gardner and Commencement Bay and somewhat more (better) for Elliott Bay. In summary, adverse effects to the quality of sediments, resulting from the selected alternatives, are not expected to be significant (per NEPA), and they would be limited to the sites.

Dredging and disposal of dredged material that is unacceptable for unconfined, open-water disposal can adversely affect water quality depending on how the dredging is conducted, the type of disposal method used, and the controls utilized to prevent unacceptable effects. Mechanically dredged materials will only produce limited discharge water from land and shore sites. Hydraulically dredged materials will produce a substantial effluent, which may result in effects to receiving water quality if return waters are not carefully controlled. For confined aquatic disposal, some of the water column effects considered minor for material acceptable for unconfined disposal become more important. The extent and magnitude of effects will be dependent on the type of material being dredged and the nature of the project.

(3) Habitat. Portions of the selected disposal sites would be periodically covered by new dredged material. This would temporarily disrupt biological activity within the impacted areas. The maximum acreage that may be impacted over time is shown in table 5.1. As the sites were located to minimize adverse effects, the biological impacts are not expected to be significant.

Habitat changes associated with the dredged material that would be placed in other disposal sites (land/shore/confined) could include loss of wetlands, loss of fish feeding and rearing habitat, loss of land vegetation, and loss of natural shoreline areas. Land sites developed for human use are usually permanently taken out of ecological production. An estimate of the possible area of land/shore habitat that would be impacted is provided (table 5.2) for

TABLE 5.1

IMPACTED BOTTOM HABITAT AT THE
PSDDA PREFERRED DISPOSAL SITES

	Long-Term Area Impacted (Acres)	Percent of Bay
Commencement Bay	310	6
Elliott Bay	415	6
Port Gardner	318	2
TOTAL	1,043	0.3 % of Phase I water area

material expected to require confined disposal. The significance of these impacts would depend on the nature of each specific site prior to use.

(4) Benthic Invertebrates. Sessile (immobile) benthic species present at the center of the unconfined, open-water sites would be buried during discharge of dredged material. This would result in the loss of most of these animals. Some may survive towards the edge of the area impacted by an individual discharge, where the material thickness does not prevent the animals from resurfacing. At the more active sites (e.g., Elliott Bay), continued physical disruption from disposal operations would preclude substantial recovery during site life in those areas of the site receiving the major amount of dredged material (immediately below disposal zone). However, some recolonization by benthic species would be likely between disposal operations in the major impact areas of all sites. Some recolonizers may experience minor increases in body burden levels of chemicals of concern within the site. These levels would not cause acute effects, nor would the levels exceed values considered to be harmful to human health, if any fish foraging at the extreme depths of the sites were captured and eaten (which is not likely). Though net losses of benthic production in the sites are considered long term, sites have been located to prevent significant adverse effects to the aquatic ecosystem as a whole.

Loss of benthic species resulting from the disposal of material not acceptable for unconfined, open-water disposal would be dependent on the specific site involved. Confined aquatic disposal and nearshore disposal sites contain benthic species that would be buried. At upland sites, land invertebrates would be buried.

TABLE 5.2

ESTIMATED LOSSES OF LAND AND SHORE HABITAT 1/
(Acres of Land/Shore)

	Port Gardner	Commencement Bay	Elliott Bay	Phase I Area
No Action (PSIC)	264	230	569	1,063
Condition I	101	96	274	471
Condition II	10	29	266	305
Condition III	0	5	162	167

1/Assumptions:

a. Almost all dredged material would be placed on land or in nearshore sites for the No Action alternative. Of the mean value for the other alternatives, some would be discharged at confined aquatic sites (CAD), the rest would be placed in land and/or shore sites. For purposes of this analysis, 60 percent of the volumes to be discharged in confined sites is assumed to be headed to land/shore, the rest (40 percent) would go to a CAD site.

b. Average depth of land/shore disposal sites is assumed to be 10 feet.

c. Forecasted over the period 1985-2000.

(5) Fish and Shellfish. Intermittent disruption of the water column during disposal operations would displace pelagic species from the disposal site. Those individuals located within and immediately adjacent to the discharge zone during disposal may experience added stress during avoidance reactions. Given the short-term and localized nature of the water column impacts, these stress effects are not considered significant.

Bottom feeding fish and mobile shellfish (crabs and shrimp) utilizing the unconfined, open-water disposal sites would be partially displaced from the area. To the extent that food value of the site is reduced over the long term, the displacement would also be long term. The displaced epifauna could experience reduced survival to the extent that the surrounding ecosystem is at carrying capacity. In addition, less mobile individuals within the site (or perhaps partially dug into the surface of the site) would be buried. By locating the sites away from areas where these species concentrate, the displacement and resulting effects should not be significant.

Adverse effects to fish and shellfish resulting from other disposal options would be dependent on the option and site selected. Confined aquatic disposal

(CAD) and nearshore sites would likely affect fish and shellfish habitat due to dredged material disposal (permanently for the nearshore option; temporarily for the CAD option). Upland sites would typically not result in direct impacts to fish and shellfish, assuming proper control of any return water (effluent).

(6) Birds and Marine Mammals. Disposal activities, with barge and tug passage and associated noise, would intermittently displace birds found at the disposal sites. Though less common, any marine mammals in the area during disposal would likely move away from the activity. Given the existing level of other navigation traffic at and near the sites, the disposal impact is not expected to be significant.

Long-term adverse effects to birds or marine mammals are not expected at the open-water sites. Adverse effects due to disposal at other disposal options would depend on the specific site involved.

(7) Fisheries. Compared to the No Action alternative, tug and barge traffic to and from the disposal sites would have a slightly higher potential for conflicts with recreational fisheries activities in each of the bays.

All three of the selected sites are located within the usual and accustomed fishing grounds (as of 1974) of several Puget Sound tribes. Potential conflicts with Indian fishing activities in these areas would be resolved by project specific actions discussed in section 2.

Adverse effects to fisheries resulting with the other disposal options could be potentially more severe with nearshore and CAD sites than with upland sites. Actual effects would depend on the site to be used.

(8) Navigation. Use of the selected disposal sites would result in temporary, localized and intermittent disruption of any navigation and anchorage use of the water surface area within the 900-foot radius disposal zones. Additionally, tug and barge traffic to and from the sites would represent potential risks for vessel collision. The disposal site locations have been coordinated with the U.S. Coast Guard and would be marked on navigation charts. Site use would be controlled to minimize the risk for vessel collision.

Using the analysis described in section 4 of the EIS, estimates of the volumes of dredged material that would and would not be acceptable for unconfined, open-water disposal are shown in table 5.3. The consequences to the cost of dredging are shown in tables 5.4, 5.5, and 5.6. In general, almost 60 percent of the forecasted dredged material that might be considered for

TABLE 5.3a

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON
DISPOSAL OF FUTURE DREDGING VOLUMES

Commencement Bay (CB) and vicinity
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated CB Unconfined, Open-Water Disposal Site 1/	Volume to Confined Disposal 2/
Site Management Condition			
I	3,929	1,348	2,581
II	3,929	3,160	769
III	3,929	3,776	153

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas 3/	Volume to Confined Disposal
No Action (PSIC) 4/	3,929	225	3,704

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would be maintained. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material will not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial-use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

TABLE 5.3b

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON DISPOSAL OF FUTURE DREDGING VOLUMES

Elliott Bay (EB) and vicinity
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated EB Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Management Condition			
I	10,525	3,113	7,412
II	10,525	3,374	7,151
III	10,525	6,162	4,363

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas3/	Volume to Confined Disposal
No Action (PSIC)4/	10,350	1,350	9,175

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would be maintained. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material will not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial-use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

TABLE 5.3c

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON DISPOSAL OF FUTURE DREDGING VOLUMES

Port Gardner (PG) and vicinity
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated PG Unconfined, Open-Water Disposal Site1/	Volume to Confined Disposal2/
Site Management Condition			
I	4.943	2,212	2,731
II	4,943	4,684	259
III	4,943	4,943	0

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas3/	Volume to Confined Disposal
No Action (PSIC)4/	4,943	675	4,268

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would be maintained. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material will not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial-use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

TABLE 5.3d

IMPACT OF ALTERNATIVE SITE MANAGEMENT CONDITIONS ON DISPOSAL OF FUTURE DREDGING VOLUMES

Total Phase I Area
1985-2000
(1,000 C.Y.)

Alternative	Total Forecasted Dredging Volume	Volume That Could be Discharged at the Designated Phase I Unconfined Open-Water Disposal Sites 1/	Volume to Confined Disposal 2/
Site Management Condition			
I	19,397	6,673	12,724
II	19,397	11,218	8,179
III	19,397	14,881	4,516

	Total Forecasted Dredging Volume	Volume That Could be Discharged in Unconfined, Open-Water Areas 3/	Volume to Confined Disposal
No Action (PSIC) 4/	19,397	2,250	17,147

1/Estimated volume of future dredged material that could be discharged at the selected sites (once designated) such that the site management condition would be maintained. Assumptions and detailed calculations used in deriving these estimates are described in EPTA (part II, section 10).

2/Confined disposal can include upland, nearshore, and/or confined aquatic disposal methods.

3/For the No Action alternative, public multiuser sites for unconfined, open-water disposal of dredged material will not be designated. Disposal of material acceptable for unconfined, open-water disposal under this alternative could occur wherever local governments and State and Federal regulatory agencies would allow. This could include beneficial-use projects and/or at other areas selected on a project by project basis.

4/PSIC: Puget Sound Interim Criteria.

TABLE 5.4

SITE-SPECIFIC TESTING, DREDGING AND DISPOSAL,
COMPLIANCE AND MONITORING COSTS FOR THE ALTERNATIVE SITE CONDITIONS

	Costs ($1,000) 1985-2000				
	Testing	Dredging & Disposal	Compliance	Monitoring	Total
Commencement Bay:					
Condition I	980	46,953	159	252	48,344
Condition II	820	21,658	373	547	23,398
Condition III	726	13,058	446	1,234	15,465
No Action	1,430	62,630	48	0	64,098
Elliott Bay:					
Condition I	5,068	159,736	367	234	165,405
Condition II	4,979	155,746	398	433	161,550
Condition III	3,874	113,285	727	692	118,598
No Action	3,674	186,572	225	0	190,471
Port Gardner:					
Condition I	1,131	52,311	261	227	53,930
Condition II	1,194	16,862	553	495	19,104
Condition III	1,210	13,148	583	1,088	16,029
No Action	1,730	74,352	112	0	76,194

TABLE 5.5

SUMMARY OF TESTING, DREDGING AND DISPOSAL,
COMPLIANCE AND MONITORING COSTS FOR THE ALTERNATIVE
SITE MANAGEMENT CONDITIONS

	Costs ($1,000) 1985-2000				
Alternative	Testing	Dredging & Disposal	Inspection	Monitoring	Total
Condition I	7,179	259,001	787	712	267,679
Condition II	6,993	194,266	1,324	1,475	204,058
Condition III	5,810	139,492	1,756	3,014	150,072
No Action (PSIC)	6,834	323,553	375	0	330,762

TABLE 5.6

TOTAL COSTS FOR TESTING, DREDGING AND DISPOSAL,
COMPLIANCE INSPECTIONS AND MONITORING OF DREDGED MATERIAL 1/
1985-2000
($1,000)

Alternative	Port Gardner	Elliott Bay	Commencement Bay	Phase I
No action (PSIC)	$76,194	$190,470	$64,098	$330,762
Condition I	53,930	165,405	48,344	267,679
Condition II	19,104	161,556	23,398	204,058
Condition III	16,029	118,518	15,465	150,001

1/Assumptions and derivations of these costs are provided in EPTA. Also see FEIS, section 4, regarding cost analysis caveats.

unconfined, open-water disposal (see EPTA for detailed calculations and assumptions) would be compatible with PSDDA Site Condition II. Actual dredged material volumes placed in unconfined, open-water disposal sites would be established by project specific evaluations, as required by Federal and State authorities. While the total cost of dredged material disposal would remain higher under PSDDA than experienced prior to 1984 and 1985, when interim criteria1/ were established for use of the disposal sites, the costs under PSDDA would be substantially less than under the Puget Sound Interim Criteria (PSIC) currently in effect. (The PSIC is associated with the PSDDA DEIS No Action alternative.)

(9) Dredging and Dredged Material Disposal. The costs of maintaining and constructing navigable waterways in Puget Sound waters has changed over the past several years, with costs rising over time. Increased costs are due to a variety of factors, but two of the more important in Puget Sound are the rise in costs for dredging and disposal of dredged material and costs for environmental evaluation of the material. The following analysis was undertaken to determine how environmental testing costs and project costs (expressed as the cost of dredging and disposal) have changed in the past 13 years in the Puget Sound region. To accomplish this task, Seattle Harbor Navigation Project maintenance dredging undertaken since 1979 is used as a case study indicator of overall trends. This Federal maintenance dredging project represents one of the most complete records of past dredging activity in Puget Sound and is fairly representative of overall dredging experience, particularly for moderate to large-size projects. A full Sound-wide study of all historical projects was not possible due to incomplete data and lack of resources to conduct such a study.

Testing costs and the volume dredged are presented in table 5.7 and illustrated in figure 5.1. The costs presented here were not adjusted for inflation (e.g., normalized to a base year), but are reported as actual costs for the year in which they were incurred.

Testing costs between 1974 and 1984 were very low, averaging less than $0.01 per c.y. of material dredged. Part of the reason for the low testing costs was the fact that the only problem area of concern was potential water column effects. Most of the testing undertaken was to assess the availability of contaminants to the water column. Another reason for the low project-specific costs is that several large dredging studies were conducted during this time period in Grays Harbor, Commencement Bay, and elsewhere in the nation which addressed many of the specific questions about dredging and water column effects. Findings from these studies were applied to all projects in the region, and reduced the need for project-specific testing and testing costs. Major studies included the Anacortes Dredging Study in 1970, Northwest Dredging Effects Study in 1974 (conducted by EPA), the Budd Inlet/Olympia Harbor study in 1975, the Grays Harbor Dredging Effects Study (1974-1976), the Dredged Material Research Program (DMRP) Duwamish River Sediment study done between 1976 and 1980, and the Bellingham study in 1980. Funds expended on these effects studies exceeded $1.5 million.

Following adoption of the Fourmile Rock Interim Criteria (FRIC) in 1984 for disposal at the existing Elliott Bay site, project-specific environmental testing costs began to rise rapidly. The focus of sediment evaluation shifted from water column effects to potential effects related to the dredged material itself; particularly to chemicals of concern that might be associated with the material. An intensive sampling scheme (one core for every 4,000 c.y.) was required and both chemical and biological testing of the material to be dredged. Material from two Seattle Harbor maintenance dredging actions have been tested since adoption of the FRIC. Environmental testing for these two projects cost $0.30 per c.y. in 1986 and $0.77 per c.y. in 1987 (table 5.7; figure 5.1). Currently, dredged material released at all disposal sites are subject to the PSIC. The FRIC no longer applies as the Elliott Bay disposal site is now closed (closed June 7, 1987).

Although no actual projects have been subjected to the PSDDA evaluation procedures, several case studies were considered in order to assess potential cost impacts of the PSDDA procedures. The projects selected were all from the Seattle area and included three projects from the Duwamish River. The case studies indicate that PSDDA would result in a change in testing costs relative to costs associated with testing under the FRIC.[2/] Testing costs under PSDDA were estimated from the case studies to range from a high of $1.00 per c.y. to a low of $0.26 per c.y. The change in testing costs range from either an increase (up by 34 percent) or a decrease (down by 32 percent) depending on project-specific attributes.

1/See EIS Section 2.
2/When compared with what might have been the result under PSIC, the changes would be expected to be similar.

TABLE 5.7
SEATTLE HARBOR NAVIGATION MAINTENANCE DREDGING:
ENVIRONMENTAL TESTING COSTS

Year	Testing Costs	Volume Dredged (c.y.)	Costs Per c.y. ($/c.y.)
1974-75	$2,500 (1)	287,000	$0.0087
1976	500	340,000	0.0015
1977	-- (2)	270,000	0.0000
1978	-- (2)	196,000	0.0000
1979-80	1,000 (3)	205,000	0.0048
1981	-- (2)	120,000	0.0000
1982		No Dredging	
1983	500	126,000	0.0040
1984	1,000	88,000	0.011
1985 (4)		No Dredging	
1986	41,350	137,000	0.30
1987	64,000	83,000	0.77

(1) Costs included testing in 1974 ($500) and in 1975 ($2,000).
(2) No testing for project dredged.
(3) Costs included testing in 1979 ($500) and in 1979 ($500).
(4) Fourmile Rock Interim Criteria (FRIC) became effective in 1984 for projects to be disposed at the existing Elliott Bay unconfined, open-water disposal site. The disposal site was closed in 1985 due to an appeal of the city of Seattle shoreline permit granted to DNR for public use of the site, and reopened in 1986. Disposal in 1986 and 1987 was subject to the FRIC. The Elliott Bay site closed again on June 7, 1987 with expiration of the shoreline permit.

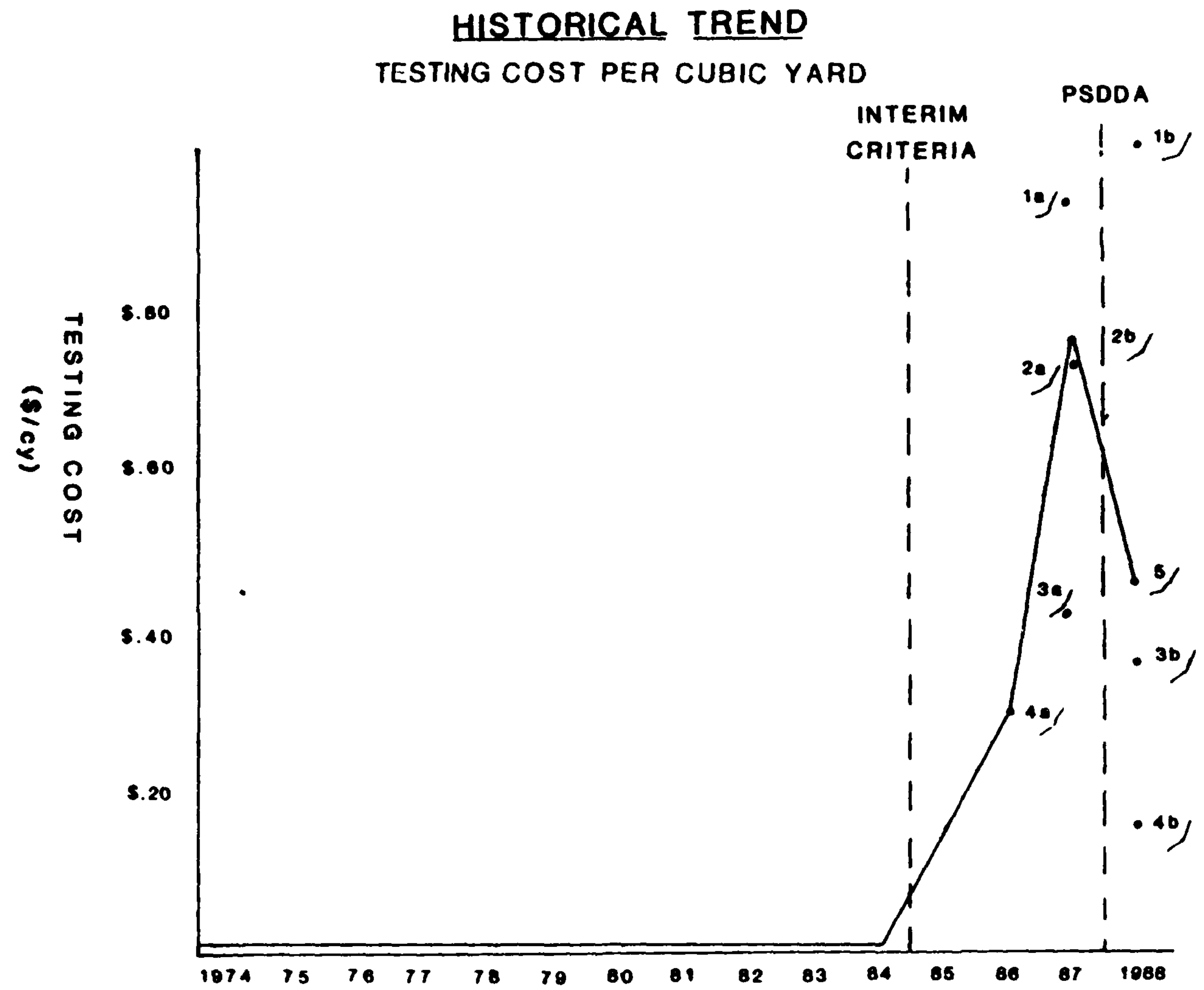


Figure 5.1: Historical trend in dredged material testing costs;
a:actual testing costs, b:testing costs under PSDDA.
1a,b: Kenmore Navigation O&M; 2a,b: Seattle Harbor O&M West Waterway;
3a,b: Port of Seattle, Terminal 30; 4a,b: Seattle Harbor O&M Upper Turning Basin;
5a,b: Average costs based on total testing costs/total cy for all four case studies.

Of the four projects used in the case study, one was Seattle Harbor maintenance dredging (included in data presented in table 5.7). In that project (for the year 1986), environmental testing costs would have been reduced from the actual $0.28 per c.y. to estimated $0.25 per c.y. had the PSDDA evaluation procedures been used.

As with testing costs, data from maintenance dredging and disposal[1/] from the Seattle Harbor (Duwamish River) were used to suggest overall trends for the Phase I area. Costs associated with dredging and disposal are presented in table 5.8 and illustrated in figure 5.2.

As shown in table 5.8, dredging and disposal costs have risen over the past 12 years, going from about $1.00 per c.y. dredged to over $3.00/c.y. This increase in costs reflects a number of factors, including inflation, a large increase for equipment, manpower, and fuel costs, and lack of available disposal sites.

For the year 1986, 25 percent of the maintenance dredging volume was required to be placed in a confined disposal site based on the results of environmental testing required under the interim criteria. This resulted in a substantial increase in disposal costs (and overall project costs) (figure 5.2). The cost analysis study suggests that significant volumes of dredged material, that might otherwise have been placed at an unconfined, open-water disposal site, would not meet the FRIC. Even less would be expected to pass PSIC. The result has been signficant increases in total projects costs.

Based on the evaluation of the 1986 Seattle maintenance work, all of the dredged material associated with this project could be allowed for unconfined, open-water disposal under the PSDDA evaluation procedures, rather than the 25 percent required for confined disposal under FRIC. Allowing all the material to go to unconfined, open-water disposal would result in a cost savings of approximately $108,000 in total project costs (figure 5.2). Overall, the trend expected under the PSDDA evaluation procedures would be to lower dredging and disposal costs over those experienced since FRIC and PSIC were introduced. This is because more material is expected to be found acceptable for open-water disposal with the PSDDA evaluation procedures which are intended to ensure site management Condition II is not exceeded.

(10) Esthetics and Recreational Use. Disposal operations at the selected sites would temporarily disrupt the viewscape esthetic quality of the surface water area at the disposal site. Though intermittent disruptions would occur, no long term or persistent effects are anticipated. Recreational use of the sites themselves is limited to occasional vessel traffic and recreational fishing activity, addressed in 5.02a(7)(8) above. Recreational enjoyment of individuals using nearby beaches and cliffs may be reduced or enhanced during disposal operations, depending on personal preferences.

1/This includes all costs, including testing, environmental studies, dredging, transportation, etc.

TABLE 5.8
SEATTLE HARBOR NAVIGATION MAINTENANCE DREDGING:
COST FOR DREDGING AND DISPOSAL 1/

Year	Dredging and Disposal Costs ($)	Volume Dredged (c.y.)	Costs Per c.y. ($/c.y.)	Disposal Method
1975	309,887	287,000	1.08	Open Water
1978	290,515	196,294	1.48	Open Water
1980	280,730	205,578	1.37	Open Water
1981	284,000	120,500	2.35	Open Water
1984	320,000	120,000	2.67	Open Water
1986	253,815	103,598	2.45	Open Water
	191,348	33,637	5.68	Confined/Upl.
1987 2/	165,000	80,160	2.06	Open Water

1/Actual costs, not adjusted for inflation.
2/Estimated costs.

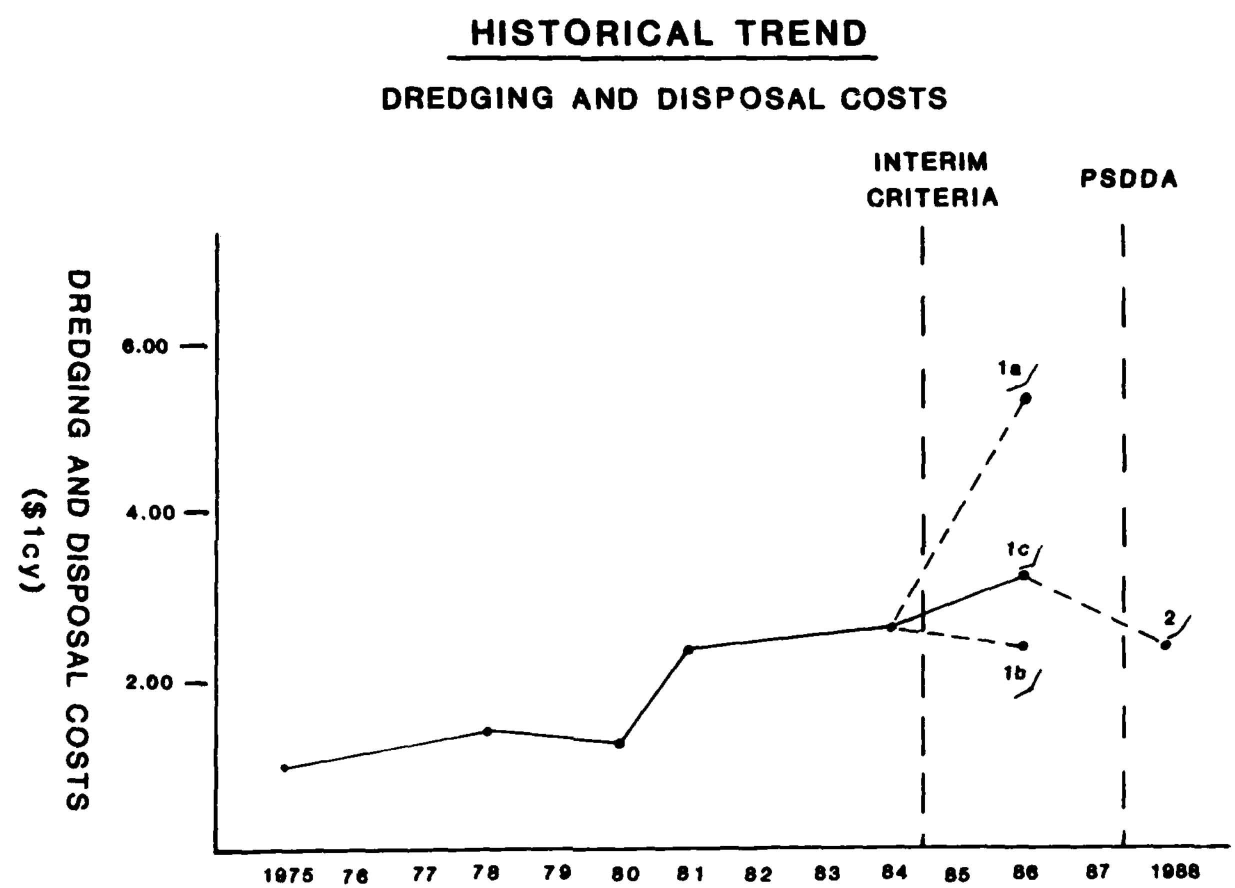


Figure 5.2: Historical trend in dredging and disposal costs.
la,b,c: Dredging and disposal costs for one project (actual). la: material costing $5.68/cy represents costs of confined nearshore disposal. lb: represents costs for material that went to unconfined open-water. ic: represents average cost/cy for the project.
2: Average cost of dredging and disposal for project shown under la,b,c, but evaluated under PSDDA guidelines. All material estimated to be suitable for open-water disposal.

(11) Puget Sound Water Quality Comprehensive Plan. The Puget Sound Water Quality Comprehensive Plan was adopted December 17, 1986. The contaminated sediment and dredging program of the plan contains a sediment program goal "to reduce and ultimately eliminate adverse effects on biological resources and humans from sediment contamination throughout the Sound by reducing or eliminating discharges of toxic contaminants and by capping, treating, or removing contaminated sediments." The plan also adopts the following policies which shall be followed by all State and local agencies in actions affecting sediment quality, including rulemaking, setting priorities for funding and action, and developing permit programs:

> "All government actions will lead toward eliminating the presence of sediments in the Puget Sound basin that cause observable adverse effects to biological resources or pose a serious health risk to humans."

> "Programs for management of dredging and disposal of sediments should result in a net reduction in the exposure of organisms to adverse effects. The intent of this policy is that dredging and disposal contribute to the cleanup of the sound by allowing unconfined open water sites to have only low levels of contamination and to dispose of more contaminated sediments in a manner that prevents continued exposure of organisms to adverse effects. For proposals where dredging will expose contaminated sediments, project-specific mitigation may be required."

> "Remedial programs (which may include capping in place) shall be undertaken when feasible to reduce, with the intent of eliminating, the exposure of aquatic organisms to sediments having adverse effects."

The PSDDA selected alternatives are consistent with this goal and these policies (see section 4).

b. Effects of Disposal: Nonselected Disposal Sites and Site Conditions. Major trends and differences between the selected and nonselected alternatives, including the No Action alternative, are summarized below.

The nonselected sites are all located in areas that are considered to be relatively more dispersive than the selected sites (the only exception to this being the Port Gardner backup site (PG 3) in Saratoga Passage). Using the nonselected sites would generally increase the potential for long-term transport of the dredged material outside the disposal sites, with possible consequent effects to offsite resources. In addition, the nonselected site 2 in Port Gardner contains more crabs that would be buried or displaced if this site were used.

Selection of Site Condition I as the management condition for the unconfined, open-water disposal sites would have shifted more dredged material to the other disposal options, resulting in greater effects on land and nearshore

environments. This alternative would decrease adverse effects in water and increase costs of dredging relative to the preferred alternative. Site Condition III would shift adverse effects of dredged material disposal away from land and back to water. Acute toxicity would be possible at the unconfined, open-water sites. Overall dredging costs would be decreased relative to those of the preferred alternative. Land and shore impacts would also be reduced.

The No Action alternative would result in the least impact on the aquatic environment and the highest costs for dredging and disposal of any alternative. The aquatic resources would remain essentially as described in section 3, subject to adverse effects from other human and natural activities. On the other hand, adverse effects from dredged material disposal on the upland and nearshore environments would be greater than all the other alternatives.

c. Effects of Dredging and Indirect Effects. Waterways used for navigation in Puget Sound have been impacted in the past, and will continue to be impacted in the future, by dredging. The adverse effects resulting at the dredging area would continue to occur with all of the alternatives considered (including the No Action alternative), since PSDDA is primarily addressing the disposal aspects of dredging. To the extent that some of the alternatives (No Action and Site Condition I) represent significant cost increases for dredging, some projects may no longer be economically feasible under these alternatives.1/ Alternately, alternatives (Site Condition III) representing a significant cost savings from past activities may result in additional dredging activity and related environmental effects. For all alternatives except the No Action alternative, these decreases in dredging activity are not expected to be significant. Consequently, adverse effects associated with dredging are not expected to differ significantly among alternatives. Only the No Action alternative would be expected to noticeably alter the dredging patterns and trends presently observed in Puget Sound with a possible decrease in dredging-related effects.

Indirect effects of the alternatives include the effects of related navigation and development at both dredging sites and land/shore disposal sites. Again, only the No Action alternative would significantly reduce the extent of these effects.

5.03 Probable, Irreversible, and Irretrievable Commitments of Resources. Use of the selected disposal sites would result in an intermittent and temporary degradation of the quality of the sites' air, noise and water resources. Additionally, intermittent use of the water surface area of the sites during disposal operations represents a commitment that may not always be in agreement with unforeseen future plans for the area. However, neither of these commitments is irretrievable.

1/An assessment of project-specific effects was beyond the scope of PSDDA. Accordingly, the actual cost impacts associated with the No Action alternative may be understated, as all material not acceptable for unconfined, open-water disposal was assumed to be placed in a confined disposal site. I.e., it was assumed that all dredging projects would be undertaken.

Designation of the selected sites for dredged material disposal would commit to this use, for the life of the sites (judged to be in excess of 15 years), 1,043 acres of benthic aquatic habitat. Fauna at the sites would be buried. Benthic production associated with the sites would be decreased. However, habitat and production values of the sites are not irretrievably lost. Partial recolonization of sites would occur when the disposal sites are not being used and full recolonization is expected in the event of site abandonment. Site specific studies at the existing DNR sites during PSDDA field work documented recovery of benthic resources at the Fourmile Rock site (section 3.03b(2)), and crab and shrimp resources at the Port Gardner DNR site (figures 3.21 and 3.24). As noted above, benthic recovery would occur during fishery closure periods or whenever the site is not used for a period of time. For the nonselected alternatives involving Site Condition III, recovery of the sites could be impeded by the presence of acutely toxic sediments. Time to recovery would be expected to be greater than for the preferred alternatives, and would be dependent on the nature of the sediments at the site and on the rate of natural sedimentation. The possibility of covering the site with cleaner material after abandonment could be used to enhance the rate of recovery should this alternative be selected.

Plants and animals buried by upland and intertidal disposal of material that is unacceptable for unconfined, open-water disposal are irretrievably lost. Ecological functions of lands filled may also be lost. While these sites are technically not irreversibly committed, in that removal of dredged material is possible with proper equipment, the lands have been committed to uses that would be very costly to reverse, and other uses of the sites are frequently precluded. Past experience indicates that any lands filled for the purpose of industrial and business development are irreversibly and irretrievably committed.

Dredged material discharged to the open-water sites represents an irreversible commitment of resources to the extent that the material was potentially useful for beneficial uses or landfill. Again, though it is not technically impossible to remove the material, retrieval would be very costly and beyond the capabilities of usually available equipment.

Commitments of nonrenewable energy resources associated with the dredging program would be irreversible. In addition, the labor and capital necessary to conduct dredging operations would be irreversibly committed. This includes the dredging equipment, administrative personnel, and both skilled and nonskilled labor. However, energy and other commitments for individual dredging projects are decided by separate economic and social factors. Commitments of human resources would be essentially identical for all the PSDDA alternatives.

5.04 <u>The Relationship Between Short-term Use of Man's Environment and The Maintenance and Enhancement of Long-term Productivity</u>. The natural characteristics of central Puget Sound have been substantially altered in the past century due to settlement and expansion of Euro-American populations, principally clustered in the present-day urban bays. Prior human occupation had not notably impacted the Sound's environment. Development and maintenance of

navigation channels has contributed to an unknown extent to the impacts on the biological resources of the Sound. These actions have generally been beneficial to the socioeconomic system, although at the expense of localized biological production. Use of the region's resources has been enhanced, resulting in development and maintenance of stable urban communities. Both beneficial and adverse effects to the environment have resulted from these developments.

Development and maintenance of navigation waterways and associated disposal of dredged material at the open-water sites are largely short-term uses of the environment. From the human environment perspective, navigation maintains and enhances the socioeconomic conditions of the area by providing low cost transportation, job security and economic stability to industries linked to shipping. Many indirect benefits to local and regional economies result from these activities.

From the biological environment perspective, long-term productivity of the Sound is neither enhanced nor maintained by the use of the selected sites. Long-term losses foreclosed by the proposed short-term uses include removal of aquatic habitats and displacement of species that utilize those habitats. Similar losses are experienced on land and shore for the other disposal options. Given the relatively small portion of the central Sound that would be impacted by disposal at the selected sites, measurable or significant reductions in regional productivity are not anticipated. And though the lost productivity is not recoverable, the sites can return to production after their use is ended.

Increased environmental sensitivity and knowledge, coupled with more stringent environmental controls being enacted and enforced by agencies with jurisdiction, should result, in the long term, in reduced introduction of contaminants from human sources to the Sound. As improved pollution source control reduces the release of contaminants into the nearshore areas of Puget Sound, overall improvement in sediment quality will follow. This should be reflected in a gradual improvement in disposal site conditions too.

5.05 <u>Mitigation and Amelioration of Adverse Effects</u>. The selected sites have been located to avoid significant adverse effects (per NEPA) while meeting the in-water disposal needs of Puget Sound dredging. Site location and site management provisions are expected to mitigate any potential biological resource and human use conflict problems. In maintaining the selected site condition, only acceptable dredged material would be discharged into the Phase I area disposal sites. Environmental monitoring of the disposal sites would allow for verification of anticipated conditions and provide a basis for site management changes if the monitoring demonstrates changes are needed.

The primary mitigation feature of the PSDDA plan is embodied in the siting process. The alternative sites are generally located away from shorelines, resources, and other amenities to preserve and maintain these resources by avoiding adverse effects due to dredged material disposal. Where complete avoidance was not possible (e.g., benthic invertebrates), the sites were

located to minimize the possible adverse effects. A minimum number of sites were identified to minimize the possible extent of bottom impacts throughout the Sound. Additionally, the sites are located in relatively nondispersive areas to minimize the possible spread of effects beyond the disposal site (including the dilution zone) via sediment transport. Special studies have been undertaken of the Elliott Bay site in cooperation with the Washington State Office of Archaeology and Historic Preservation as mitigation for shipwrecks found there (see FEIS exhibits C and D).

The adopted regional, effects-based disposal site management condition is designed to avoid any future discharge of sediments containing unacceptable levels of chemicals of concern and resulting in unacceptable adverse effects. Chemical effects on biological resources at the unconfined, open-water disposal sites would be minimized by the selected site condition. In combination with the environmental monitoring, the site condition will ensure that there is no acute toxicity to sensitive species onsite and unacceptable effects do not occur outside the disposal site. These management conditions fully comply with the applicable provisions of the State Water Quality Standards.

Another important mitigation feature of PSDDA is contained in the compliance inspection and monitoring plans. Appropriate compliance inspections by the PSDDA regulatory agencies will ensure that the site use conditions are met, such that planned avoidance of adverse effects can be realized. Appropriate disposal site environmental monitoring will provide needed verification of predicted site conditions within and outside the established sites resulting from the effects of dredged material disposal.

SECTION 6. PUBLIC INVOLVEMENT

6.01 Study Coordination/Public Involvement. Public involvement procedures of NEPA and SEPA were followed to ensure that issues of concern to the public were properly addressed. The Puget Sound Estuary Program (PSEP) mailing list of over 2,500 was used to inform interested agencies, organization, and individuals of study activities through newsletters and public meeting notices. Periodic articles on PSDDA have also been included in the PSEP "Puget Sound Notes," a bimonthly newletter.

During May 1985, PSDDA agencies held six public EIS scoping meetings in the Puget Sound area (cities of Seattle, Everett, Tacoma, Olympia, Bellingham, and Port Townsend). In addition, each of the three work groups conducted a number of working sessions, sharing technical information and giving participants, including citizens, representatives of ports, Indian tribes, environmental groups, local governments, and other Federal and State agencies, opportunities to make recommendations on work group outputs. Routine work group meetings have been open to public participation, as well.

Several newsletters, containing updates on the status of PSDDA and information on study findings, were published. The first newsletter included comments and issues raised at the May 1985 public meetings and the PSDDA responses. The second issue released in April 1986 contained preliminary study findings for the Phase I area. A third newsletter was distributed in January 1988 to advise the public of the availability of the draft Phase I documents and of public meetings held in February 1988.

A major display on dredging was included as part of a Puget Sound exhibit by the Seattle Aquarium. A "PSDDA" information brochure was provided to the public attending the exhibit. Three public workshops were held in May 1986 where the preliminary findings were presented and the public given an opportunity to comment on these findings. Final public meetings were held in Seattle and in Port Townsend to obtain public comments on the DEIS and other draft Phase I documents.

PSDDA has been coordinated closely with the PSEP and the PSWQA. Joint funding of common interest technical studies was accomplished with both of these programs. Also, the PSDDA study director and others of the study team were members of advisory committees established by PSEP and PSWQA. Similarly, staff involved in the latter two programs attended PSDDA work group sessions. Other coordination has included, but was not limited to, the following:

Federal

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
U.S. Fish and Wildlife Service
U.S. Navy
U.S. Coast Guard

State of Washington
Department of Natural Resources
Department of Ecology
Department of Transportation
Department of Fisheries
Department of Wildlife
Department of Commerce
Department of Social and Health Services
Parks and Recreation Commission
Puget Sound Water Quality Authority

Indian Tribes
Duwamish Tribal Office
Jamestown Klallam Tribes
Lower Elwha Tribal Council
Lummi Business Council
Muckleshoot Indian Tribe
Nisqually Indian Community
Nooksack Indian Tribal Council
Northwest Indian Fisheries Commission
Point No Point Treaty Council
Port Gamble Business Committee
Puyallup Tribal Council
Sauk-Suaittle Indian Tribe
Skokomish Tribal Council
Small Tribes of Western Washington
Squaxin Island Tribal Council
Stillaguamish Tribal Council
Suquamish Tribal Council
Swinomish Tribal Council
Tulalip Board of Directors
Upper Skagit Tribal Council

Local Government
San Juan County
Mason County
Thurston County
Island County
Jefferson County
Whatcom County
Kitsap County
Snohomish County
King County
Pierce County
Clallam County
Skagit County
City of Bellingham
City of Everett
City of Seattle
City of Anacortes
City of Tacoma

Local Government (con.)
City of Olympia
City of Port Angeles
Association of Washington Cities
Association of Washington Counties
Puget Sound Council of Governments (PSCOG)
Municipality of Metropolitan Seattle (Metro)

Ports
Port of Edmonds
Port of Bellingham
Port of Everett
Port of Seattle
Port of Skagit County
Port of Anacortes
Port of Port Townsend
Port of Tacoma
Port of Port Angeles
Port of Bremerton
Port of Olympia
Washington Public Ports Association

Other Public Organizations
Washington Environmental Council
Puget Sound Alliance
Greenpeace
Friends of the Earth

6.02 Key Federal Coordination Requirements. Special efforts were undertaken pursuant to Federal NEPA coordination requirements with the following:

o U.S. Fish and Wildlife Service and National Marine Fisheries Service. As these two Federal agencies have special responsibilities for fish and wildlife protection, participation of agency representatives was sought and obtained for the three PSDDA technical work groups where the basic PSDDA plan elements were formulated. Both agencies were provided copies of the internal PSDDA review draft documents in December 1986 and January 1987. Also both agencies provided inputs and responded to the biological assessments and coordination documents prepared for threatened and endangered species which may be found in the vicinity of Phase I area disposal sites (see exhibit A to this EIS). Comments by these agencies on the January 1988 draft documents are contained in FEIS exhibits C and D.

o Local Shoreline Jurisdictions and the State Shoreline's Office of Ecology. In order to ensure compliance with the Federal Coastal Zone Management Act special meetings were held with the Phase I area local governments having shoreline jurisdiction over the Phase I area alternative disposal sites. Also extensive coordination was accomplished through correspondence and these jurisdictions received the December 1986, January 1987, and January 1988 draft documents for review. Similar coordination was accomplished with

Ecology's shoreline office. The National Coastal Zone Management Act (Public Law 91-583: 86 Stat. 1280) was passed by the United States Congress in 1972. Under this act:

"(1) Each Federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs.

(2) Any Federal agency which shall undertake any development project in the coastal zone of a state shall insure that the project is, to the maximum extent practicable, consistent with approved state management programs.

(3) After final approval by the secretary of a state's management program, any applicant for a required Federal license or permit to conduct an activity affecting land or water uses in the coastal zone of that state shall provided in the application to the licensing or permitting agency a certification that the proposed activity complies with the state's approved program and that such activity will be conducted in a manner consistent with the program."

In June 1976, the State Coastal Zone Management Program (CZMP) was approved to receive funding. The Washington State Shoreline Management Act (SMA) of 1971, as passed by the State Legislature, provided "for the management of Washington's shorelines by planning and fostering all reasonable and appropriate uses." The SMA and State CZMP are implemented through the Shoreline Master Programs (SMP) of large municipalities and the counties. The management plan for the PSDDA Phase I area is consistent with all applicable Puget Sound SMP's and so satisfies consistency with State and Federal coastal zone management requirements.

o Washington State Office of Archaeology and Historic Preservation. During the disposal site evaluation process, careful consideration was given to shipwrecks that might lie within or near the alternative disposal sites. None were identified during the literature review accomplished in conjunction with the site mapping used for site identification (see DSSTA). In March 1988, additional literature reviews and sidescan sonar studies of the selected sites were conducted. While this additional effort confirmed the absence of shipwrecks at the Commencement Bay and Port Gardner sites, shipwrecks were discovered at the Elliott Bay site. Coordination is continuing with the State Office of Archaeology and Historic Preservation on the additional studies that will mitigate for adverse impacts to the Elliott Bay shipwrecks (see FEIS exhibits C and D).

o Phase I Area and Other Indian Tribes. Special coordination was undertaken with the Indian tribes having treaty fishing rights to avoid, to tne maximum possible, conflicts with treaty fishing activities. Meetings were held with tribal representatives of the Muckleshoot, Tulalip, Suquamish, and Puyallup tribes. These tribes were also provided the December 1986 and January 1987 internal PSDDA review draft documents and the January 1988 public review draft documents for comment. Adjustments were made in plan elements in response to tribal inputs (see section 2 of this EIS).

6.03 Remaining Coordination. Further coordination with interested parties took place during and subsequent to the public review of the DEIS and other Phase I draft documents. Public meetings on the draft documents were held on 10 and 11 February 1988.

6.04 Environmental Impact Statement Recipients. The DEIS was distributed to over 500 organizations and individuals for a 45-day public review in accordance with Federal and State of Washington environmental policy acts. The list of recipients is on file at the Seattle District, U.S. Army Corps of Engineers, and can be obtained by contacting Mr. Frank J. Urabeck, PSDDA Study Director. This FEIS has been provided to all recipients of the DEIS.

6.05 Public Views and Responses. Comments on the DEIS and responses by the PSDDA agencies are contained in exhibit C to this EIS.

SECTION 7. LIST OF EIS CONTRIBUTORS

Frank J. Urabeck	P.E., Civil Engineer B.S., Civil Engineering, 1962 University of Washington M.A., Economics, 1975 University of Maryland 10 years, navigation planning, Corps of Engineers; 16 years, water resources development, Corps of Engineers (14); and Department of Interior (2)
Keith Phillips	B.S., Oceanography, 1977 University of Washington 10 years, oceanography and environmental planning, Corps of Engineers
Dr. David R. Kendall	Ph.D., Benthic Ecology, 1978 Emory University 5 years, environmental effects of dredging research, Corps of Engineers (WES) 3 years, environmental planning and biology, Corps of Engineers 3 years, contaminant research, Skidaway Institute of Oceanography 2 years, environmental regulation
Dr. Stephen Martin	Ph.D., Invertebrate Ecology, 1971 University of Washington 12 years, environmental planning and biology, Corps of Engineers; 4 years, invertebrate aquaculture, Atomic Energy Commission
Brian Ross	M.S., Fisheries, 1982 University of Washington 3 years, environmental review EPA Seattle/Alaska 1 year, environmental science, Jones and Stokes, Inc. 2-1/2 years, fishery biology, University of Washington
Carl Kassebaum	P.E., Civil Engineer M.S., Civil Engineering, 1973 University of Washington 14 years, environmental regulation, planning and compliance, EPA (12 Seattle, 2 Wash. D.C.)

Steve Tilley	M.S., Public Health, 1973 University of North Carolina 12 years, environmental resource management, Wash. Dept. of Natural Resources (6), Wash. Dept. of Ecology (2), Lewis County (3), Wahkiakum County (1)
Justine Smith	M.A., Marine Affairs, pending 1987 University of Washington B.S., Biology, 1984, Duke University 3 years, marine planning and policy, National Oceanic and Atmospheric Administration
Catherine Krueger	M.A., Marine Resource Management, 1984, University of Washington B.S., Biology, 1980, Warren Wilson College 3 years, marine resource management and policy, EPA 3 years, fishery biology, National Marine Fisheries Service, Alaska
Dr. David Jamison	Ph.D., Marine Pollution, 1970 University of Washington M.S., Zoology, 1966 University of Washington 11 years, marine research and aquatic lands management, Washington Depart-ment of Natural Resources 3 years, forest research management, Washington Department of Ecology 4 years, oil pollution studies, Washington Department of Ecology
Jim Thornton	B.A., Psychology, 1969 Eastern Washington State College 12 years, environmental regulation and policy planning, Washington Department of Ecology
Dr. D. Michael Johns	Ph.D., Biological Oceanography, 1980 University of South Carolina 15 years, contaminant fate and effects, Tetra Tech Inc. (1); EPA Narragansett (10); and Belle W. Baruch Institute (4)

GLOSSARY OF TERMS AND ABBREVIATIONS

PUGET SOUND DREDGED DISPOSAL ANALYSIS (PSDDA)
GLOSSARY OF TERMS

Amphipods. Small shrimp-like crustaceans (for example, sand fleas). Many live on the bottom, feed on algae and detritus, and serve as food for many marine species. Amphipods are used in laboratory bioassays to test the toxicity of sediments.

Apparent Effects Threshold. The sediment concentration of a contaminant above which statistically significant biological effects would always be expected.

Area Ranking. The designation of a dredging area relative to its potential for having sediment chemicals of concern. Rankings range from "low" potential to "high" potential, and are used to determine the intensity of dredged material evaluation and testing that might be required.

Baseline Study. A study designed to document existing environmental conditions at a given site. The results of a baseline study may be used to document temporal changes at a site or document background conditions for comparison with another site.

Bathymetry. Shape of the bottom of a water body expressed as the spatial pattern of water depths. Bathymetric maps are essentially topographic maps of the bottom of Puget Sound.

Benthic Organisms. Organisms that live in or on the bottom of a body of water.

Bioaccumulation. The accumulation of chemical compounds in the tissues of an organism. For example, certain chemicals in food eaten by a fish tend to accumulate in its liver and other tissues.

Bioassay. A laboratory test used to evaluate the toxicity of a material (commonly sediments or wastewater) by measuring behavioral, physiological, or lethal responses of organisms.

Biota. The animals and plants that live in a particular area or habitat.

Bottom-Dump Barge. A barge that disposes of dredged material by opening along a center seam or through doors in the bottom of the barge.

Bottomfish. Fish that live on or near the bottom of a body of water, for example, English sole.

Bulk Chemical Analyses. Chemical analyses performed on an entire sediment sample, without separating water from the solid material in a sample.

Capping. See confined aquatic disposal.

Carcinogenic. Capable of causing cancer.

Clamshell Dredging. Scooping of the bottom sediments using a mechanical clamshell bucket of varying size. Commonly used in over a wide variety of grain sizes and calm water, the sediment is dumped onto a separate barge and towed to a disposal site when disposing in open water.

Code of Federal Regulations. The compilation of Federal regulations adopted by Federal agencies through a rule-making process.

Compositing. Mixing sediments from different samples to produce a composite sample for chemical and/or biological testing.

Confined Disposal. A disposal method that isolates the dredged material from the environment. Confined disposal may be in aquatic, nearshore, or upland environments.

Confined Aquatic Disposal (CAD). Confined disposal in a water environment. Usually accomplished by placing a layer of sediment over material that has been placed on the bottom of a water body (i.e., capping).

Contaminant. A chemical or biological substance in a form or in a quantity that can harm aquatic organisms, consumers of aquatic organisms, or users of the aquatic environment.

Contaminated Sediment.

Technical Definition: A sediment that contains measurable levels of contaminants.

Management or Common Definition: A sediment that contains sufficient concentration(s) of chemicals to produce unacceptable adverse environmental effects and thus require restriction(s) for dredging and/or disposal of dredged material (e.g., is unacceptable for unconfined, open water disposal or conventional land/shore disposal, requiring confinement).

Conventional Nearshore Disposal. Disposal at a site where dredged material is placed behind a dike in water along the shoreline, with the final elevation of the fill being above water. "Conventional" disposal additionally means that special contaminant controls or restrictions are not needed.

Conventional Pollutants. Sediment parameters and characteristics that have been routinely measured in assessing sediment quality. These include sulfides, organic carbon, etc.

Conventional Upland Disposal. Disposal at a site created on land (away from tidal waters) in which the dredged material eventually dries. Upland sites are usually diked to confine solids and to allow surface water from the disposal operation to be released. "Conventional" disposal additionally means that special contaminant controls or restrictions are not needed.

Depositional Analysis. A scientific inspection of the bottom sediments that identifies where natural sediments tend to accumulate.

Depositional Area. An underwater region where material sediments tend to accumulate.

Disposal. See confined disposal, conventional nearshore disposal, conventional upland disposal, and unconfined, open-water disposal.

Disposal Site. The bottom area that receives discharged dredged material; encompassing, and larger than, the target area and the disposal zone.

Disposal Site Work Group. The PSDDA work group that is designating locations for open-water unconfined dredged material disposal sites that are environmentally acceptable and economically feasible.

Disposal Zone. The area that is within the disposal site that designates where surface release of dredged material will occur. It encompasses the smaller target area. (See also "target area" and "disposal site".)

Dredged Material. Sediments excavated from the bottom of a waterway or water body.

Dredged Material Management Unit. The maximum volume of dredged material for which a decision on suitability for unconfined open-water disposal can be made. Management units are typically represented by a single set of chemical and biological test information obtained from a composite sample. Management units are smaller in areas of higher chemical contamination concern (see "area ranking").

Dredger. Private developer or public entity (e.g., Federal or State agency, port or local government) responsible for funding and undertaking dredging projects. This is not necessarily the dredging contractor who physically removes and disposes of dredged material (see below).

Dredging. Any physical digging into the bottom of a water body. Dredging can be done with mechanical or hydraulic machines and is performed in many parts of Puget Sound for the maintenance of navigation channels that would otherwise fill with sediment and block ship passage.

Dredging Contractor. Private or public (e.g., Corps of Engineers) contractor or operator who physically removes and disposes of dredged material for the dredger (see above).

Disposal Site Work Group. The PSDDA work group that is designating locations for open-water unconfined dredged material disposal sites that are environmentally acceptable and economically feasible.

Ecosystem. A group of completely interrelated living organisms that interact with one another and with their physical environment. Examples of ecosystems

are a rain forest, pond, and estuary. An ecosystem, such as Puget Sound, can be thought of as a single complex system. Damage to any part may affect the whole. A system such as Puget Sound can also be thought of as the sum of many interconnected ecosystems such as the rivers, wetlands, and bays. Ecosystem is thus a concept applied to various scales of living communities and signifying the interrelationships that must be considered.

Effluent. Effluent is the water flowing out of a contained disposal facility. To distinguish from "runoff" (see below) due to rainfall, effluent usually refers to water discharged during the disposal operation.

Elutriate. The extract resulting from mixing water and dredged material in a laboratory test. The resulting elutriate can be used for chemical and biological testing to assess potential water column effects of dredged material disposal.

Entrainment. The addition of water to dredged material during disposal, as it descends through the water column.

Environmental Impact Statement. A document that discusses the likely significant environmental impacts of a proposed project, ways to lessen the impacts, and alternatives to the proposed project. EIS's are required by the National and State Environmental Policy Acts.

Erosion. Wearing away of rock or soil via gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical and chemical forces.

Estuary. A confined coastal water body where ocean water is diluted by inflowing fresh water, and tidal mixing occurs.

Evaluation Procedures Work Group. The PSDDA work group that is developing chemical and biological testing and test evaluation procedures for dredged material assessment.

Gravid. Having eggs, such as female crabs carrying eggs.

Ground Water. Underground water body, also called an aquifer. Aquifers are created by rain which soaks into the ground and flows down until it collects at a point where the ground is not permeable.

Habitat. The specific area or environment in which a particular type of plant or animal lives. An organism's habitat provides all of the basic requirements for life. Typical Puget Sound habitats include beaches, marshes, rocky shores, bottom sediments, mudflats, and the water itself.

Hazardous Waste. Any solid, liquid, or gaseous substance which, because of its source or measurable characteristics, is classified under State or Federal law as hazardous, and is subject to special handling, shipping, storage, and disposal requirements. Washington State law identifies two categories of hazardous waste: dangerous and extremely hazardous. The latter category is more hazardous and requires greater precautions.

Hopper Dredge. A hydraulic suction dredge that is used to pick up coarser grain sediments (such as sand), particularly in less protected areas with sea swell. Dredged materials are deposited in a large holding tank or "hopper" on the same vessel, and then transported to a disposal site. The hopper dredge is rarely used in Puget Sound.

Hydraulic Dredging. Dredging accomplished by the erosive force of a water suction and slurry process, requiring a pump to move the water-suspended sediments. Pipeline and hopper dredges are hydraulic dredges.

Hydraulics Project Approval. RCW 75.20.100 Approval from the Washington Department of Fisheries and Washington Department of Wildlife for the use, diversion, obstruction or change in the natural flow or bed of any river or stream, or that will use any salt or fresh waters of the State.

Hydraulically Dredged Material. Material, usually sand or coarser grain, that is brought up by a pipeline or hopper dredge. This material usually includes slurry water.

Hydrocarbon. An organic compound composed of carbon and hydrogen. Petroleum and its derived compounds are hydrocarbons.

Infauna. Animals living in the sediment.

Intertidal Area. The area between high and low tide levels. The alternate wetting and drying of this area makes it a transition between land and water organisms and creates special environmental conditions.

Leachate. Water or other liquid that may have dissolved (leached) soluble materials, such as organic salts and mineral salts, derived from a solid material. Rainwater that percolates through a sanitary landfill and picks up contaminants is called the leachate from the landfill.

Local Sponsor. A public entity (e.g., port district) that sponsors Federal navigation projects. The sponsor seeks to acquire or hold permits and approvals for disposal of dredged material at a disposal site.

Loran C. An electronic system to facilitate navigation positioning and course plotting/tracking.

Management Plan Work Group. The PSDDA work group is developing a management plan for each of the open-water dredged material disposal sites. The plan will define the roles of local, State, and Federal agencies. Issues being addressed include: permit reviews, monitoring of permit compliance, treatment of permit violations, monitoring of environmental impacts, responding to unforeseen effects of disposal, plan updating, and data management.

Material Release Screen. A laboratory test proposed by PSDDA to assess the potential for loss of fine-grained particles carrying chemicals of concern from the disposal site during disposal operations.

Mechanical Dredging. Dredging by digging or scraping to collect dredged materials. A clamshell dredge is a mechanical dredge. (See "hydraulic dredging.")

Metals. Metals are naturally occurring elements. Certain metals, such as mercury, lead, nickel, zinc, and cadmium, can be of environmental concern when they are released to the evironment in unnatural amounts by man's activities.

Microlayer, Sea Surface Microlayer. The extremely thin top layer of water that can contain high concentrations of natural and other organic substances. Contaminants such as oil and grease, many lipophylic (fat or oil associated) toxicants, and pathogens may be present at much higher concentrations in the microlayer than they are in the water column. Also the microlayer is biologically important as a rearing area for marine organisms.

Microtox. A laboratory test using luminescent bacteria and measuring light production, used to assess toxicity of sediment extracts.

Molt. A complex series of events that results in the periodic shedding of the skeleton, or carapace by crustaceans (all arthropods for that matter). Molting is the only time that many crustaceans can grow and mate (particularly crabs).

Monitor. To systematically and repeatedly measure something in order to detect changes or trends.

Nutrients. Essential chemicals needed by plants or animals for growth. Excessive amounts of nutrients can lead to accelerated growth of algae and subsequent degradation of water quality due to oxygen depletion. Some nutrients can be toxic at high concentrations.

Overdepth Material. Dredged material removed from below the dredging depth needed for safe navigation. Through overdepth is incidentally removed due to dredging equipment precision, its excavation is usually planned as part of the dredging project to ensure proper final water depths. Common overdepth is 2 feet below the needed dredging line.

Oxygen Demanding Materials. Materials such as food waste and dead plant or animal tissue that use up dissolved oxygen in the water when they are degraded through chemical or biological processes. Chemical and biological oxygen demand (COD and BOD, respectively) are different measures of how much oxygen demand a substance has.

Parameter. A quantifiable or measurable characteristic of something. For example, height, weight, sex, and hair color are all parameters that can be determined for humans. Water quality parameters include temperature, pH, salinity, dissolved oxygen concentration, and many others.

Pathogen. A disease-causing agent, especially a virus, bacteria, or fungi. Pathogens can be present in municipal, industrial, and nonpoint source discharges to the Sound.

Permit. A written warrant or license, granted by an authority, allowing a particular activity to take place. Permits required for dredging and disposal of dredged material include the U.S. Army Corps of Engineers Section 404 permit, the Washington State Department of Fisheries Hydraulics Permit, the city or county Shoreline Development Permit, and the Washington Department of Natural Resources Site Use Disposal Permit.

Persistent. Compounds that are not readily degraded by natural physical, chemical, or biological processes.

Pesticide. A general term used to describe any substance, usually chemical, used to destroy or control organisms (pests). Pesticides include herbicides, insecticides, algicides, and fungicides. Many of these substances are manufactured and are not naturally found in the environment. Others, such as pyrethrum, are natural toxins which are extracted from plants and animals.

pH. The degree of alkalinity or acidity of a solution. Water has a pH of 7.0. A pH of less than 7.0 indicates an acidic solution, and a pH greater than 7.0 indicates a basic solution. The pH of water influences many of the types of chemical reactions that occur in it. Puget Sound waters, like most marine waters, are typically pH neutral.

Phase I. The PSDDA study is divided into two, 3-year long, overlapping phases. Phase I covers the central area of Puget Sound including Seattle, Everett, and Tacoma. Phase I began in April 1985.

Phase II. The PSDDA study is divided into two, 3-year long, overlapping phases. Phase II covers the north and south Sound (including, Olympia, Bellingham, and Port Angeles)--the areas not covered by Phase I. Hood Canal is not being considered for location of a disposal site. Phase II began in April 1986.

Pipeline Dredge. A hydraulic dredge that transports slurried dredged material by pumping it via a pipe. (See "hydraulic dredge".)

Point Source. Locations where pollution comes out of a pipe into Puget Sound.

Polychaete. A marine worm.

Polychlorinated Biphenyls. A group of manmade organic chemicals, including about 70 different but closely related compounds made up of carbon, hydrogen, and chlorine. If released to the environment, they persist for long periods of time and can concentrate in food chains. PCB's are not water soluble and are suspected to cause cancer in humans. PCB's are an example of an organic toxicant.

Polycyclic (Polynuclear) Aromatic Hydrocarbon. A class of complex organic compounds, some of which are persistent and cancer-causing. These compounds are formed from the combustion of organic material and are ubiquitous in the environment. PAH's are commonly formed by forest fires and by the combustion

of fossil fuels. PAH's often reach the environment through atmospheric fall-out, highway runoff, and oil discharge.

Priority Pollutants. Substances listed by EPA under the Clean Water Act as toxic and having priority for regulatory controls. The list includes toxic metals, inorganic contaminants such as cyanide and arsenic, and a broad range of both natural and artificial organic compounds. The list of priority pollutants includes substances that are not of concern in Puget Sound, and also does not include all known harmful compounds.

Puget Sound Water Quality Authority. An agency created by the Washington State legislature in 1985 and tasked with developing a comprehensive plan to protect and enhance the water quality of Puget Sound. The Authority adopted its first plan in January 1987.

Range Markers. Pairs of markers which, when aligned, provide a known bearing to a boat operator. Two pairs of range markers can be used to fix position at a point.

Regional Administrative Decisions. A term used in PSDDA to describe decisions that are a mixture of scientific knowledge and administrative judgment. These regionwide policies are collectively made by all regulatory agencies with authority over dredged material disposal to obtain Sound-wide consistency.

Regulatory Agencies. Federal and State agencies that regulate dredging and dredged material disposal in Puget Sound, along with pertinent laws/permits, include:

U.S. Army Corps of Engineers

- River and Harbor Act of 1899 (Section 10 permits)
- Clean Water Act (Section 404 permits)

U.S. Environmental Protection Agency

- Clean Water Act (Section 404 permits)

Washington Department of Natural Resources

- Shoreline Management Act (site use permits)

Washington Department of Ecology

- Clean Water Act (Section 401 certifications)
- Shoreline Management Act (CZMA consistency determinations)

Washington Department of Fisheries

- Hydraulics Project Approval

Washington Department of Wildlife (Formerly Washington Department of Game)

o Hydraulics Project Approval

Local shoreline jurisdiction e.g., City of Seattle, City of Everett, Pierce County

o Shoreline permit to non-Federal dredger/DNR

U.S. Fish and Wildlife Service (Key reviewing agency)

National Marine Fisheries Service (Key reviewing agency)

The Resource Conservation and Recovery Act. The Federal law that regulates solid and hazardous waste.

Respiration. The metabolic processes by which an organism takes in and uses oxygen and releases carbon dioxide and other waste products.

Revised Code of Washington. The compilation of the laws of the State of Washington published by the Statute Law Committee.

Runoff. Runoff is the liquid fraction of dredged materials or the flow/seepage caused by precipitation landing on and filtering through upland or nearshore dredged material disposal sites.

Salmonid. A fish of the family Salmoniidae. Fish in this family include salmon and trout. Many Puget Sound salmonids are anadromous, spending part of their life cycles in fresh water and part in marine waters.

Sediment. Material suspended in or settling to the bottom of a liquid, such as the sand and mud that make up much of the shorelines and bottom of Puget Sound. Sediment input to Puget Sound comes from natural sources, such as erosion of soils and weathering of rock, or anthropogenic sources, such as forest or agricultural practices or construction activities. Certain contaminants tend to collect on and adhere to sediment particles. The sediments of some areas around Puget Sound contain elevated levels of contaminants.

Site Condition. The degree of adverse biological effects that might occur at a disposal site due to the presence of sediment chemicals of concern; the dividing line between "acceptable" (does not exceed the condition) and "unacceptable" (exceeds the site condition) adverse effects at the disposal site. Other phrases used to describe site condition include "biological effects condition for site management" and "site management condition."

Spot Checking. Inspections on a random basis to verify compliance with permit requirements.

Statistically Significant. A quantitative determination of the statistical degree to which two measurements of the same parameter can be shown to be different, given the variability of the measurements.

Subtidal. Refers to the marine environment below low tide.

Suspended Solids. Organic or inorganic particles that are suspended in water. The term includes sand, mud, and clay particles as well as other solids suspended in the water column.

Target Area. The specified area on the surface of Puget Sound for the disposal of dredged material. The target area is within the disposal zone and within the disposal site.

Toxic. Poisonous, carcinogenic, or otherwise directly harmful to life.

Toxic Substances and Toxicants. Chemical substances, such as pesticides, plastics, detergents, chlorine, and industrial wastes that are poisonous, carcinogenic, or otherwise harmful to life if found in sufficient concentrations.

Treatment. Chemical, biological, or mechanical procedures applied to an industrial or municipal discharge or to other sources of contamination to remove, reduce, or neutralize contaminants.

Turbidity. A measure of the amount of material suspended in the water. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. Very high levels of turbidity can be harmful to aquatic life.

Unconfined, Open-Water Disposal. Discharge of dredged material into an aquatic environment, usually by discharge at the surface, without restrictions or confinement of the material once it is released.

Variable Range Radar. Radar equipped with markers which allow measurement of bearings and distances to known targets.

Vessel Traffic Service (VTS). A network of radar coverage for ports of Puget Sound operated by the Coast Guard to control ship traffic. Most commercial vessels are required to check in, comply with VTS rules, and report any change in movement.

Volatile Solids. The material in a sediment sample that evaporates at a given high temperature.

Washington Administrative Code. Contains all State regulations adopted by State agencies through a rulemaking process. For example, Chapter 173-201 WAC contains water quality standards.

Water Quality Certification. Approval given by Washington State Department of Ecology which acknowledges the compliance of a discharge with Section 401 of the Clean Water Act.

Waterways Experiment Station (WES). Corps of Engineers (Corps) research facility located in Vicksburg, Mississippi, that performs research and support projects for the various Corps districts.

Wetlands. Habitats where the influence of surface or ground water has resulted in development of plant or animal communities adapted to such aquatic or intermittently wet conditions. Wetlands include tidal flats, shallow subtidal areas, swamps, marshes, wet meadows, bogs, and similar areas.

Zoning. To designate, by ordinances, areas of land reserved and regulated for specific land uses.

ABBREVIATIONS

AET. Apparent Effects Threshold.

CFR. *Code of Federal Regulations.*

Corps. U.S. Army Corps of Engineers.

CWA. The Federal Clean Water Act, previously known as the Federal Water Pollution Control Act.

DEIS. Draft Environmental Impact Statement.

DMRP. Dredged Material Research Program.

DNR. Washington Department of Natural Resources.

DSS TA. Disposal Site Selection Technical Appendix.

DSWG. Disposal Site Work Group.

Ecology. Washington Department of Ecology.

EIS. Environmental Impact Statement.

EPA. Environmental Protection Agency.

EPTA. Evaluation Procedures Technical Appendix.

EPWG. Evaluation Procedures Work Group.

FVP. Field Verification Program.

HPA. Hydraulics Project Approval. RCW 75.20.100.

ML. Maximum Level.

MPTA. Management Plans Technical Appendix.

MPWG. Management Plan Work Group.

NEPA. National Environmental Policy Act.

PAH. Polycyclic (Polynuclear) Aromatic Hydrocarbon.

PCB's. Polychlorinated Biphenyls.

PMP. Proposed Management Plan.

PSDDA. Puget Sound Dredged Disposal Analysis.

PSEP. Puget Sound Estuary Program.

PSIC. Puget Sound Interim Criteria.

PSWQA. Puget Sound Water Quality Authority.

RAD's. Regional Administrative Decisions.

RCRA. The Resource Conservation and Recovery Act.

RCW. Revised Code of Washington.

SEPA. State Environmental Policy Act.

SL. Screening Level.

SMA. Shoreline Mangement Act.

WAC. Washington Administrative Code.

WES. Waterways Experiment Station.

401. Section 401 of the Clean Water Act.

404. Section 404 of the Clean Water Act.

4MR. The Fourmile Rock DNR disposal site in Elliott Bay.

EXHIBIT A
THREATENED AND ENDANGERED SPECIES,
BIOLOGICAL ASSESSMENTS AND COORDINATION

Exhibit A

Threatened and Endangered Species,
Biological Assessments and Coordination

Contents

- Concurrence letter from National Marine Fisheries Service
- Concurrence letter from U.S. Fish and Wildlife Service
- Biological Assessment on Marine Mammals
- List of Threatened and Endangered Species from National Marine Fisheries Service
- Biological Assessment on Bald Eagle
- List of Threatened and Endangered Species from U.S. Fish and Wildlife Service

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E.
BIN C15700, Building 1
Seattle, WA 98115

February 19, 1987 F/NWR5:AG

Mr. R. P. Sellevold
Chief, Engineering Division
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Sellevold:

We have reviewed the Biological Assessment (BA) for the Puget Sound Dredged Disposal Analysis (PSDDA). We concur with the conclusion of the BA that Phase I of the study is unlikely to affect species under jurisdiction of the National Marine Fisheries Service (NMFS) that are listed under the Endangered Species Act as threatened or endangered.

Unless new information should indicate otherwise, NMFS requires no further consultation on Phase I of the PSDDA.

Sincerely,

Thomas E Kruse

for Rolland A. Schmitten
Regional Director

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Olympia Field Office
2625 Parkmont Lane SW, B-2
Olympia, Washington 98502
206/753-9444 FTS 434-9444

March 25, 1987 Re: 1-3-87-I-122

Mr. R. P. Sellevold
Chief, Engineering Division
Seattle District, Corps of Engineers
PO Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Sellevold:

This is in response to your February 4, 1987 letter transmitting the biological assessment evaluating the possible effects to bald eagles from the implementation of the proposed Puget Sound Dredged Disposal Analysis study in Pierce, King and Snohomish counties, Washington. The assessment analyzed possible impacts from in-water dredged disposal at designated sites in Commencement Bay, Elliott Bay, and Port Gardner.

We have reviewed your assessment and concur with your finding of no effect to the bald eagle as a result of implementing the proposed action. Therefore it is our opinion that the Corps has complied with the requirements of Sections 7(a)(2) and 7(c) of the Endangered Species Act of 1973, as amended, thereby concluding the consultation process.

Sincerely,

James L. Michaels
Acting Field Supervisor

c: WDG (nongame)
WNHP

NPSEN-PL-ER 29 January 1987

PUGET SOUND DREDGED DISPOSAL ANALYSIS
BIOLOGICAL ASSESSMENT ON MARINE MAMMALS
FOR THE PHASE I AREA (CENTRAL PUGET SOUND)

1. Background. The Puget Sound Dredged Disposal Analysis (PSDDA) is a program for the management of unconfined, open-water disposal of dredged material in waters of Puget Sound. The program includes: (1) designation of acceptable disposal sites, (2) definition of dredged material evaluation procedures, and (3) disposal site management plans.

Recently there has been heightened public and agency concern over the long-term environmental health of Puget Sound and the role dredged material played in perceived water and sediment quality problems. Questions have been raised over project-by-project dredged material evaluation processes, and some felt that the existing public disposal sites were not at the "best" locations. Due to expiring local shoreline master program permits, by July 1987, only one of the three central Puget Sound existing unconfined, open-water disposal sites will remain open. That site is permitted only to June 1988. This condition creates uncertainty with regard to future disposal of dredged material and highlights the urgency of having an acceptable dredged material disposal program. A proposed program has been developed through a special Federal-state cooperative study.

The U.S. Army corps of Engineers (Corps), U.S. Environmental Protection Agency (EPA), Washington Department of Natural Resources (DNR), and Washington Department of Ecology (Ecology) began the PSDDA study in April 1985. The study is a 3-year-long effort being conducted in two overlapping phases, each 2 years in length. Phase I covers central Puget Sound, including the sound's major urban centers, Tacoma, Seattle, and Everett (see figure 1). Phase II, initiated in April 1986, covers the north and south Sound area, including Olympia, Port Angeles, and Bellingham.

The goal of PSDDA is to provide environmentally safe and publicly acceptable guidelines governing unconfined, open-water disposal of dredged material, thereby improving consistency and predictability in the decisionmaking process.

The Corps is the lead Federal agency for this study and as such has responsibility for meeting the requirements of section 7 of the Endangered Species Act of 1973, as amended (Public Law 97-304). Seven species of endangered whales and one endangered sea turtle are found in Washington waters, according to the December 3, 1986 letter from National Marine Fisheries Service. These are the sperm whale (*Physeter macrocephalus*), gray whale (*Eschrichtius robustus*), fin whale (*Balaenoptera physalus*), sei whale (*B. borealis*), blue whale (*B. musculus*), humpback whale (*Megaptera novaeangliae*), right whale (*Eubalaena glacialis*), and leatherback sea turtle (*Dermochelys coriacea*). This biological assessment (BA) evaluates the alternative unconfined open-water disposal sites considered by PSDDA for central Puget Sound (see paragraph 2 for description) for possible impacts to these species.

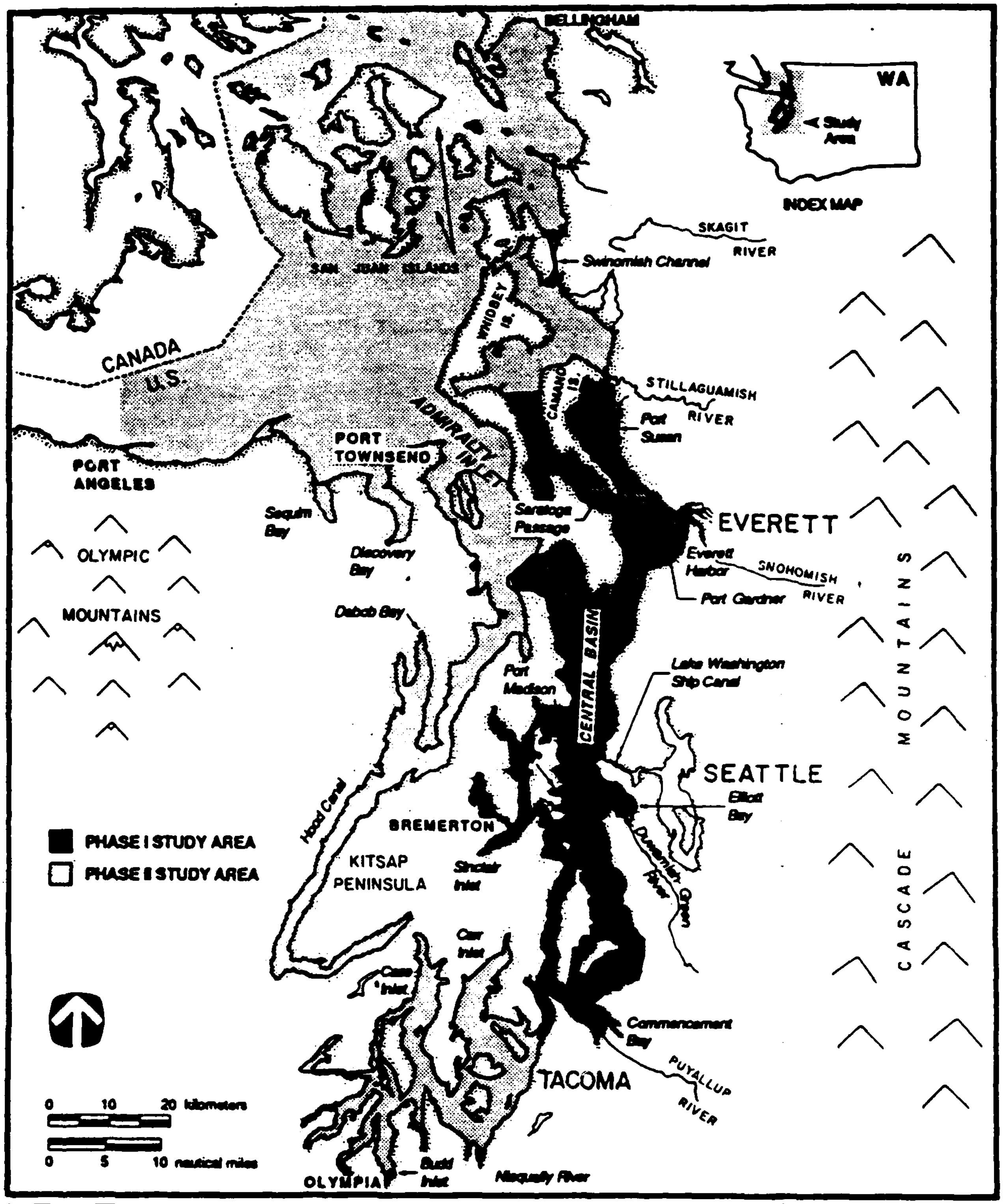


Figure 1. Puget Sound, Washington

2. Project Description.

a. General. Three public multiuser unconfined, open-water disposal sites have been identified which will partially meet the future dredged material disposal needs of the Phase I area. More than 50 percent of future dredged material is expected to be found unsuitable for this disposal option and will need to be confined in aquatic capped, nearshore, or upland facilities. A preferred unconfined, open-water disposal site has been located in each of the Tacoma, Seattle, and Everett urban embayments of Commencement Bay, Elliott Bay, and Port Gardner, respectively. The sites, while varying in size primarily due to bathymetry, average about 350 acres in potential bottom impact area. Each site includes a 900-foot radius, 58-acre surface disposal zone within which all dredged material must be released. See figure 2 for the location of the preferred and alternative sites.

The preferred disposal sites are all located to avoid areas with important biological resources and human use activities. The center of the Commencement Bay preferred disposal zone is located approximately 1 mile west of Browns Point in water about 530 feet deep. In Elliott Bay, the center of the preferred disposal zone is located about 3/4 of a mile north of Harbor Island in water 265 feet deep. The center of the Port Gardner preferred disposal zone is located about 2-1/4 miles southeast of Gedney Island in approximately 420 feet of water.

b. Site Selection Process. The PSDDA site selection process utilized existing information in combination with field studies to identify preferred and alternative disposal sites. The approach used is similar to that described in the EPA and COE workbook entitled "General Approach to Designation of Studies for Ocean Dredged Material Disposal Sites" (EPA, 1984). Steps of the site selection process were as follows:

(1) Define general siting philosophy. (This step addresses disposal philosophy (i.e., whether sites should be dispersive or nondispersive), general siting locations (i.e., ocean, strait, or sound), and number of disposal sites.)

(2) Identify selection factors to delineate Zones of Siting Feasibility (ZSF's). (This step uses existing information on biological resources and human use activities to identify general areas where disposal sites might be appropriately located.)

(3) Conduct field studies on the ZSF's. (Field and model studies are conducted to fill key data gaps and gather information on the physical and biological conditions of the ZSF's. Since these studies were conducted to check the general condition of the ZSF's, they are sometimes referred to as "checking studies.")

(4) Identify preliminary sites within the ZSF's. (Information from the ZSF studies is used to identify preliminary locations for disposal sites within the ZSF's.)

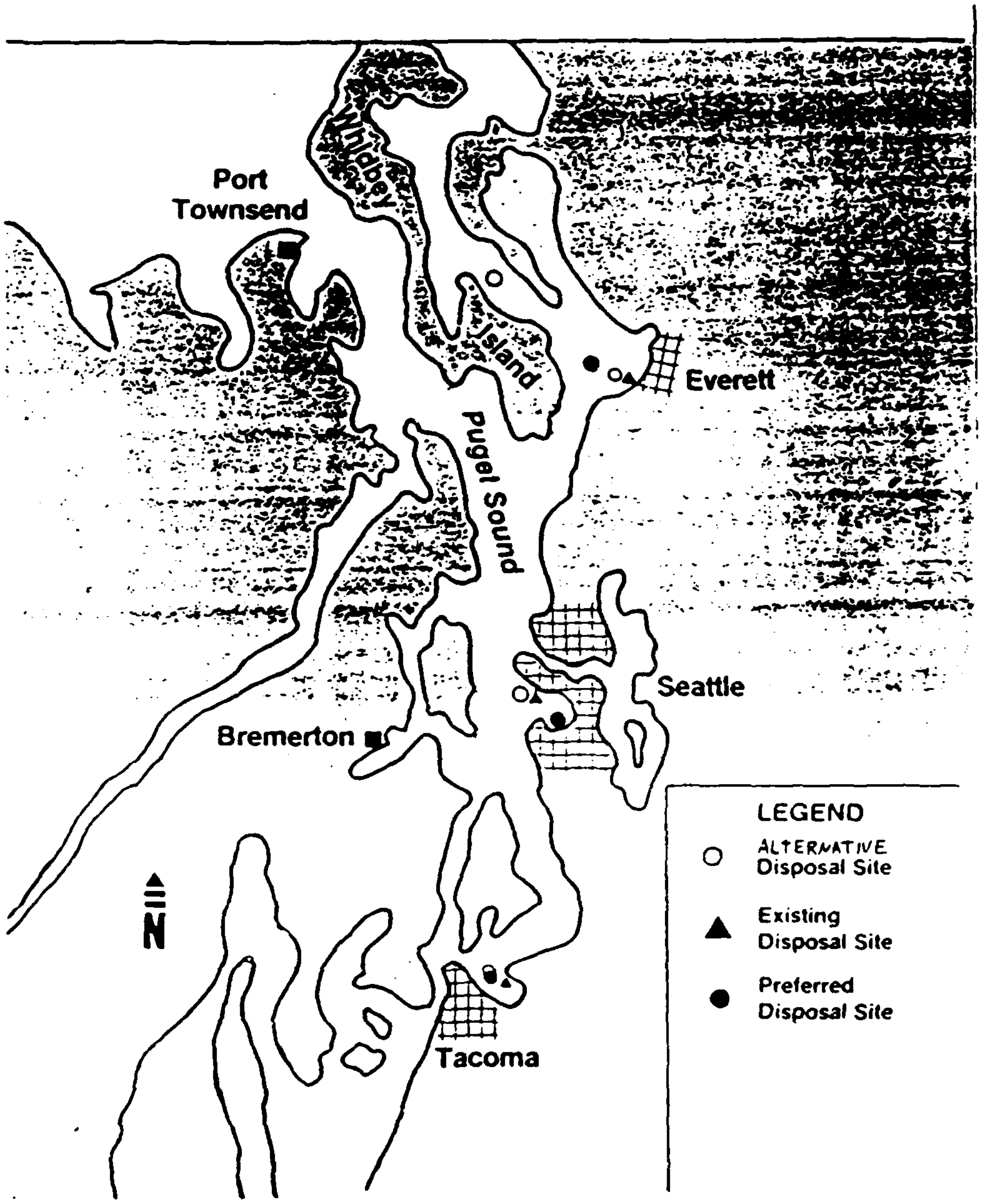


Figure 2 Disposal Site Locations, Phase I Area

(5) Conduct field studies on the sites. (Field and model studies are conducted to obtain needed physical and biological information for the preliminary sites. These studies are referred to as "site-specific studies.")

(6) Identify preferred sites. (Information from the site-specific studies is used to identify preferred and alternative sites.)

Existing DNR disposal sites were considered in the disposal site selection process if they met site selection factors discussed below. All cooperating agencies in PSDDA agreed early on that no special a priori consideration would be given to the existing sites, because of human use conflicts and environmental concerns with past dredging and disposal protocols. An objective site selection process was used to minimize environmental and human usage conflicts as much as possible, and existing sites adequately meeting the site selection factors and constraints were given equal consideration with other potential sites.

Early in the PSDDA study it was determined that open-water unconfined disposal sites in the Phase I area should be relatively nondispersive rather than dispersive in nature. Placing dredged material in nondispersive sites gives site managers the ability to maintain control and accountability over site conditions. This is particularly important when chemical contaminants may be present in the dredged material and it is necessary to minimize the exposure of important resources.

c. General ZSF Selection Factors. Three general ZSF selection factors were identifid early in the PSDDA study. It was determined that ZSFs should, to the maximum extent possible:

First, avoid high energy areas that would disperse dredged material significantly beyond the disposal site area.

Second, avoid significant adverse impacts on foodfish, shellfish, marine mammals, and marine birds.

And third, minimize interference with human uses to the lowest practicable level.

d. Specific ZSF Selection Factors. The three general ZSF selection factors were further defined by nineteen specific selection factors (shown in table 1). Most of these factors are identified in Federal and State regulations relating to dredged material disposal sites located in water.
The specific factors were mapped and overlayed to display areas where siting might occur with a minimum of conflict.

TABLE 1

SPECIFIC FACTORS FOR IDENTIFICATION OF
ZONES OF SITING FEASIBILITY

1. Navigation activities
2. Recreational uses
3. Cultural sites
4. Aquaculture facilities
5. Utilities
6. Scientific study areas
7. Point pollution sources
8. Water intakes
9. Shoreline land use designations
10. Political boundaries
11. Location of dredging areas
12. Beneficial uses of dredged material
13. Fish/shellfish harvest areas
14. Threatened and endangered species
15. Fish/shellfish habitat
16. Wetlands, mudflats and vegetated shallows
17. Bathymetry
18. Sediment characteristics
19. Water currents

e. Site in Commencement Bay Area. The preferred site in the Commencement Bay ZSF was identified based on results of ZSF and site-specific studies.

(1) Commencement Bay Preferred Site. The center of the Commencement Bay preferred site is located at Latitude 47d 18.22m and Longitude 122d 27.84m and lies approximately 1 mile west of Browns Point (figure 3). The center of the existing DNR disposal site is located 1.2 nautical miles southeast of the preferred site, with the northwestern edge of the site only 230 yards from the preferred site boudary. The preferred site is elliptical in shape, covering approximately 310 acres, with a long axis of 4,600 feet oriented parallel to the tidal current flood-ebb direction and short axis of 3,800 feet. The bottom slope at this site is approximately 1-foot vertical to 200 feet of horizontal distance, which is essentially flat. The proposed site lies in an area where sediments tend to deposit rather than erode, as suggested by clay composition exceeding 15 percent, water content exceeding 50 percent, volatile solids exceeding 4 percent, and biochemical oxygen demand exceeding 500 (data summary from Depositional Analysis). The small grain size (i.e., medium silt) suggests that current speeds lie below the 25 centimeter per second threshold; and are backed up by numerical model results suggesting peak speeds of 18-20 centimeters per second. At this current speed dredged materials disposed should not be resuspended by local currents. Net current direction appears to be toward the southwest and the site is oriented accordingly.

COMMENCEMENT BAY

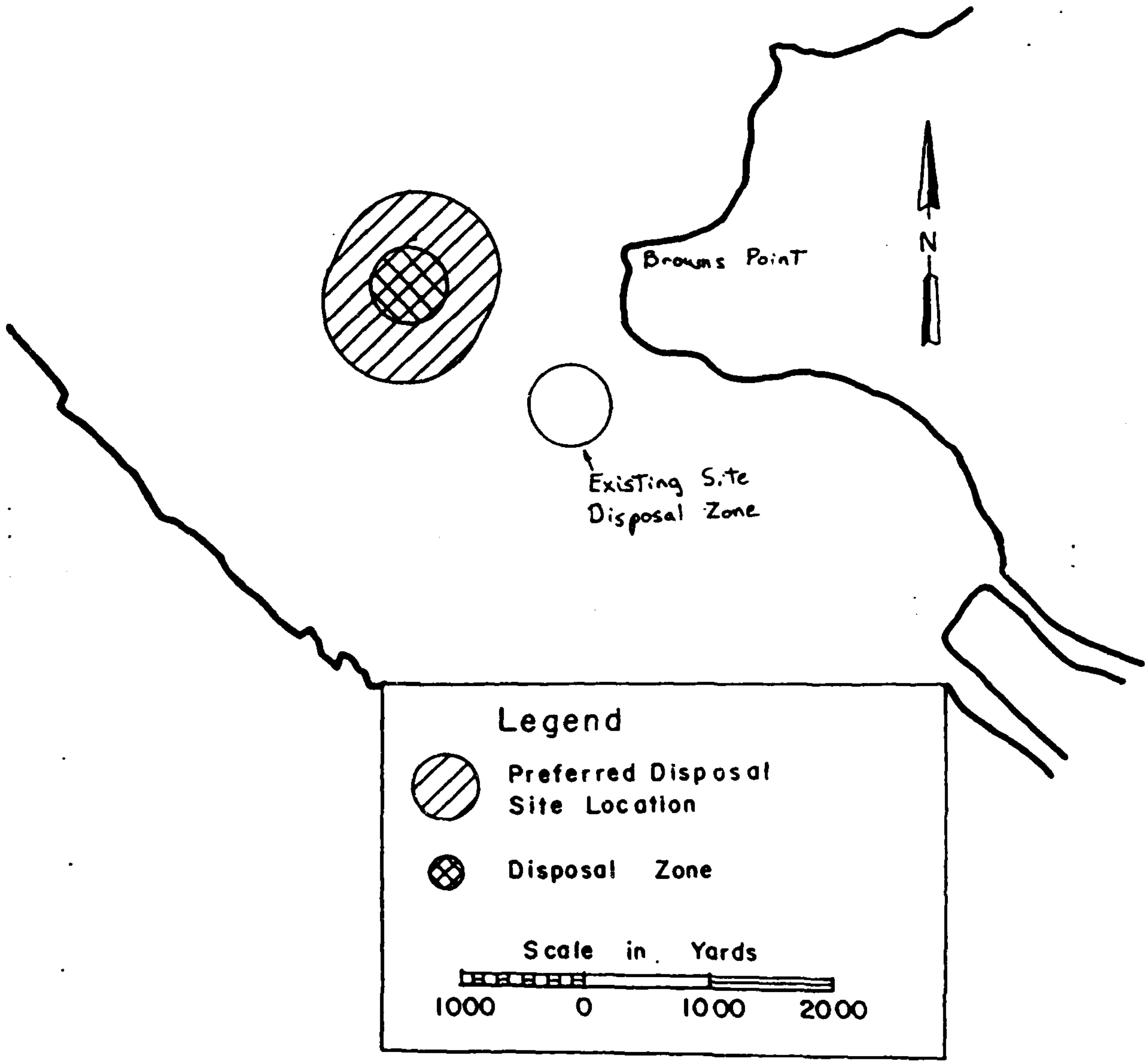


Figure 3   Commencement Bay Disposal Site

f. Site in Elliott Bay Area. The preferred site for the Elliott Bay ZSF was identified based on results of ZSF and site-specific studies.

(1) Elliott Bay Preferred Site. The center of the preferred site in Elliott Bay is located at Latitude 47d 36.03m and Longitude 122d 21.34m within the confines of a depositional area near the mouth of the Duwamish River (figure 4). The disposal site is shaped like a large egg with the south end of the site located in approximately 200 feet of water and the north end of the site located in approximately 360 feet of water. The site is approximately 6,200 feet in length and 4,000 feet wide, covering 415 acres. The site is located in a submarine valley with relatively steep sides and a downward slope ranging from 1:30 to 1:50.

g. Site in the Port Gardner Area. The preferred site for the Port Gardner ZSF was identified based on results of ZSF and site-specific studies.

(1) Port Gardner Preferred Site. The center of the preferred Port Gardner site is located at Latitude 47d 58.86m and Longitude 122d 16.62m, and lies approximately two nautical miles west of Everett Harbor (figure 5). The 318-acre site is circular and located in 420 feet of water on a large flat plane with a diameter of 4,200 feet. Bottom slopes are less than 1 feet vertical on 200 feet horizontal. Because bottom slope and tidal currents should not significantly alter the disposal site configuration, the delineated site is a 4,000-foot-diameter circle that is concentric with the 1,800-foot-diameter drop zone.

3. Methods. Individuals knowledgeable of marine mammals in the Puget Sound area were contacted and interviewed. Available literature was reviewed and pertinent information was used in this assessment. References are listed at the end of this assessment.

4. Expected Impacts of PSDDA on Endangered Marine Animals. The following section is divided into three major subsections: Description of the Environment; Use of Puget Sound by Endangered Marine Animals; and Potential Impacts to Endangered Marine Animals. The second subsection is broken down to: General; Commencement Bay; Elliott Bay; and Port Gardner.

a. Description of the Environment. Puget Sound is an inland arm of the Pacific Ocean that connects to the Pacific through the Strait of Juan de Fuca. Puget Sound is not in the direct pathway of marine mammal migration routes, and consequently is seldom used by marine mammals. However, the Sound is rich in resources and when marine mammals do venture into this inland "sea" they find protected bays and food.

b. Use of Puget Sound by Marine Animals.

(1) General. Of the eight species of listed marine animals discussed in this BA, the right, blue, sei, and sperm whales and the leatherback sea turtle have never been observed with certainty in the inside waters of Washington. The blue whale has never been verified from the inside waters,

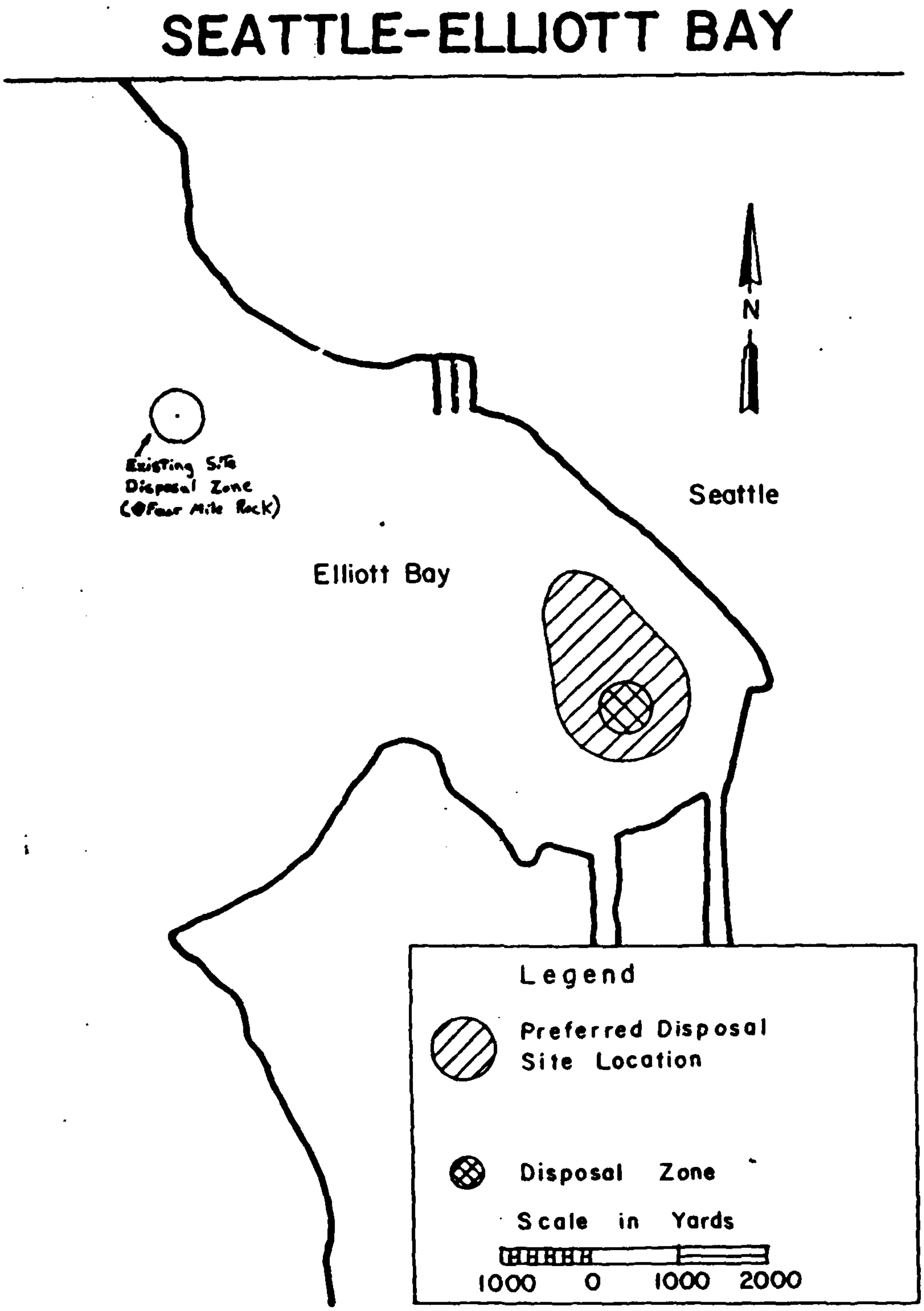


Figure 4 Ellitt Bay Disposal Site

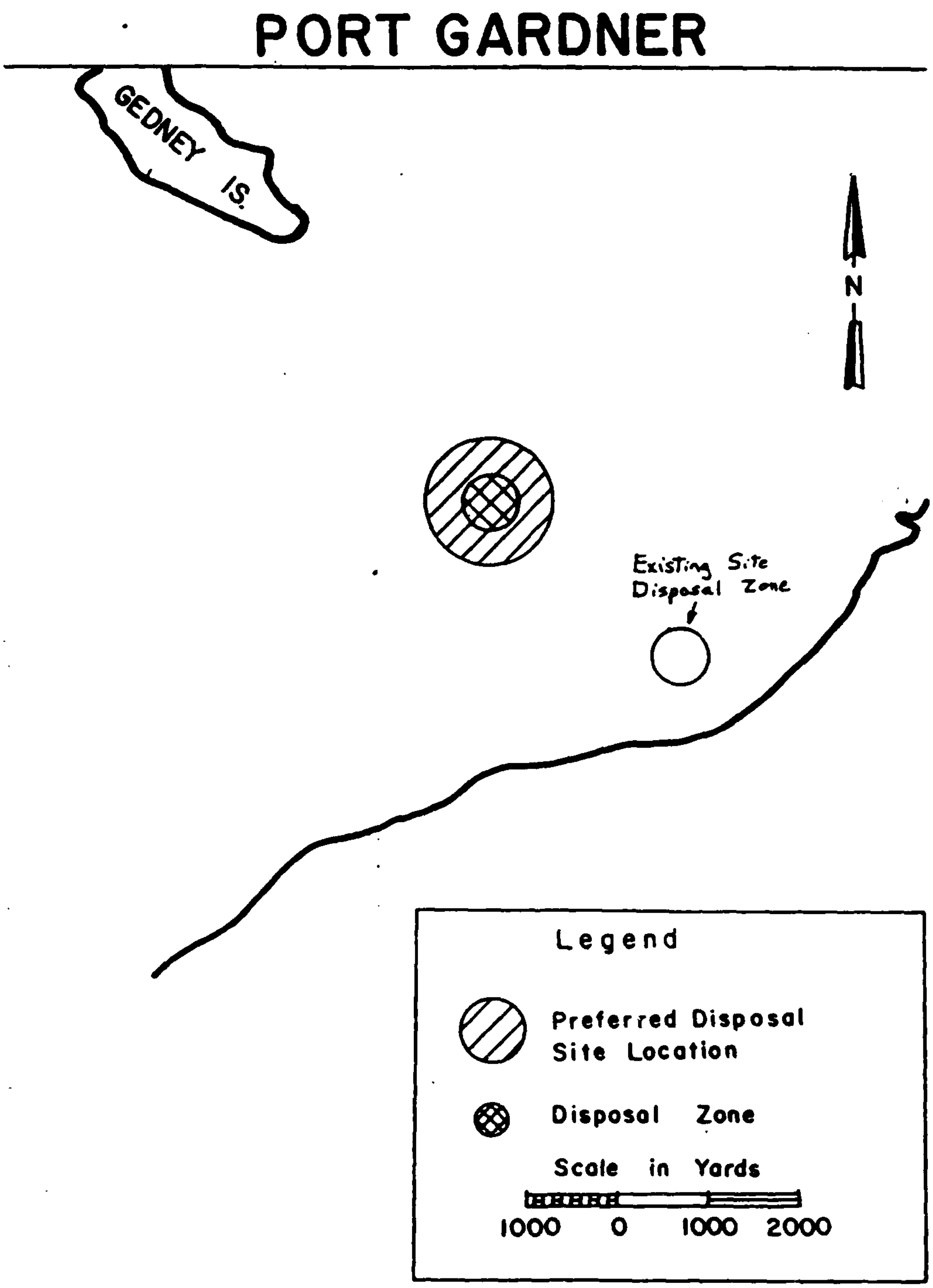


Figure 5 Port Gardner Disposal Site

though it is speculated that a whale identified as a fin whale in 1930 in Shelton may actually have been a young blue whale (National Marine Mammal Labortory, 1980). This fin whale sighting is the only one in Puget Sound, and the chances of it occurring again in Puget Sound are quite remote. These species are not discussed further in the BA.

Only the gray and humpback whales occur in Puget Sound and are discussed below.

Gray whales are regularly, though infrequently, sighted in Puget Sound. These individuals are considered stragglers which may or may not feed while in Puget Sound. Some of the few recent sightings of gray whales in Puget Sound have been relativley close to each of the preferred alternative disposal sites. In each case, the whales were present for no more than 1 day and were not seen again in the same area. The implication is that the whales are "passing through" (and in all likelihood not feeding) and find no special attraction for any one area.

The humpback whale generally inhabits coastal and offshore waters but does enter protected inside waters on occasion. In the eastern North Pacific Ocean this species ranges from the Arctic to southern California in summer and occupies tropical waters in winter. The North Pacific population is estimated to be about 1,000 animals.

During the first part of the 20th century this species was one of those most frequently sighted in the inside waters of Washington. Recent sightings of this species in Puget Sound were made off Seattle, Washington in May, 1976 (2 individuals) and in September, 1978 (4 individuals).

Humpback whales could occur anywhere in the inside waters of Washington but the chance of more than a few stragglers occurring is slight.

(2) Commencement Bay. Gray whales have been regularly, though certainly not commonly, observed in Dalcos Passage and in the outer reaches of Commencement Bay. Gray whales feed in water depths between 40 and 125 feet, primarily for euphausiid shrimp, nektonic fishes, and anchovy. However, feeding has only been noted in northern migrant gray whales; those migrating south toward the breeding area apparently fast during migration. Those observed in Puget Sound are apparently stragglers who may stay in Washington waters for extended periods. No one seems to know whether these stragglers feed while they are in Washington waters (Everitt, et al., 1979).

Humpback whales have apparently not been observed near Tacoma or southern Puget Sound since the 1940's (Slipp, 1948, Fide Everitt, et al., 1979). They are now one of the rarest of whales, numbering less than 1,000 individuals, and chances of seeing them again in southern Puget Sound are remote.

(3) Elliott Bay. Gray whales are regularly observed near Elliott Bay (Everitt, et al., 1979). They do not stay in a particular location for long, though they appear to stay in Puget Sound for extended periods. It is not known whether these stragglers eat while in Puget Sound.

Humpback whales were once commonly sighted in Puget Sound, but sightings have been rare since the 1940's. Two sightings have been made in recent years near Elliott Bay, one in 1976 and one in 1978 (Everitt, et al., 1979). The first sighting was of two animals that were breaching and observed from the Seattle-Winslow ferry. The second sighting was of four animals observed from Fauntleroy. Though these sightings are hopeful, a comeback to historic numbers by this species is considered remote and more than occasional sightings are not expected.

(4) Port Gardner. Gray Whales have been sighted in Port Susan at Kayak Point in 1984. As at Commencement and Elliott Bays, the gray whales seen near Port Gardner are stragglers and do not stay in any one location for long.

There are no recent sightings of humpback whales near Port Gardner. Their rarity makes the possibility of regular sightings remote.

c. Impacts to Gray Whales and Humpback Whales.

(1) General. Both gray whales and humpback whales occur so rarely in Puget Sound that the chances for impacts to these species from open water disposal is extremely remote at any of the proposed disposal sites. Therefore, separate discussion of impacts at each disposal site is not included.

5. Summary and Conclusions: Endangered marine animals are extremely rare in Puget Sound. The low likelihood of their occurrence near the preferred alternative disposal sites means that Phase I of PSDDA would not impact any listed marine species.

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UNITED STATES DEP...ATMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E.
BIN C15700, Building 1
Seattle, Washington 98115

December 3, 1986 F/NWR5:AG

Mr. R. P. Sellevold, P.E.
Chief, Engineering Division
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Sellevold:

In response to your letter of November 12, 1986, regarding identification of sites for disposal of dredge material in Puget Sound, enclosed is a list of endangered and threatened species under jurisdiction of the National Marine Fisheries Service (NMFS) that may occur within central Puget Sound.

This area has no candidate species under review by NMFS for consideration for proposed listing under the Endangered Species Act.

Sincerely,

Thomas E. Kruse

for Rolland A. Schmitten
Regional Director

Enclosure

EASTERN NORTH PACIFIC MARINE SPECIES
LISTED UNDER THE ENDANGERED SPECIES ACT

Marine animals which are found in the eastern North Pacific Ocean at some season of the year, which are listed as endangered under the Endangered Species Act of 1973, and which could conceivably enter the Strait of Juan de Fuca and the inside waters of Washington are:

Gray Whale	(*Eschrichtius robustus*)
Blue Whale	(*Balaenoptera musculus*)
Humpback Whale	(*Megaptera novaeangliae*)
Right Whale	(*Balaena glacialis*)
Fin Whale	(*Balaenoptera physalus*)
Sei Whale	(*Balaenoptera borealis*)
Sperm Whale	(*Physeter macrocephalus*)
Leatherback Sea Turtle	(*Dermochelys coriacea*)

However, four of these species have never been reported as occurring within the Strait of Juan de Fuca or other inside waters of Washington; they are:

Right Whale

Sei Whale

Sperm Whale

Leatherback Sea Turtle

The others occur only rarely or occasionally within inside waters. The Blue Whale may have been sighted once and the Fin Whale only once or twice. A few individual Gray Whales have been sighted almost every year. It is highly

unlikely, however, that a significant number of any of these five species would enter and travel within the Strait of Juan de Fuca, the San Juan Islands area, Puget Sound or Hood Canal.

Accounts for each species are as follows. Additional information on the marine mammals of Washington can be found in "Northern Puget Sound Marine Mammals" by Everitt, Fiscus and DeLong (1980, Environmental Protection Agency Report EPA-600/7-80-130).

Gray Whale

The Gray Whale is primarily a coastal species. A few stray annually into the inside waters of Washington. The eastern North Pacific stock of 15-17,000 whales passes along the Washington coast in late winter and spring (Mar-May) during its northbound migration and in winter (Nov-Jan) during its southbound migration. A few animals may be seen in coastal Washington waters during any month of the year. A summer population of 50 animals regularly occurs along the West Coast of Vancouver Island where they feed.

There are numerous observations of Gray Whales from the waters inside of Washington including the Strait of Juan de Fuca, the San Juan Islands, Puget Sound, and Hood Canal over the past decade. These were mostly solitary animals. Larger aggregations include: a 6 May 1979 observation of a group in Hood Canal and a 9 May 1979 observation of 1-5 at Port Townsend which may have been the group sighted in Hood Canal three days earlier.

Gray Whales could occur anywhere in the inside waters of Washington but the chance of more than a few stragglers occurring is slight.

Blue Whale

The Blue Whale is primarily an offshore species. In the eastern North Pacific it ranges from the Gulf of Alaska to central California during summer and in the eastern tropical Pacific during winter. A recent estimate of the North Pacific population is 1,700.

There are no verified sightings of this species from the Strait of Juan de Fuca or other inside waters of Washington, although there is speculation that the whale (identified as a Fin) which died in a log boom at Shelton, WA in August, 1930 may have been a young Blue Whale.

The Blue Whale is an offshore species rarely venturing into shallow coastal or protected inside waters of Washington.

Humpback Whale

The Humpback Whale generally inhabits coastal and offshore waters but does enter protected inside waters on occasion. In the eastern North Pacific Ocean this species ranges from the Arctic to southern California in summer and occupies tropical waters in winter. The North Pacific population is estimated to be about 1,000 animals.

During the first part of the 20th century this species was one of those most frequently sighted in the inside waters of Washington. Recent sightings of this species in Puget Sound were made off Seattle, WA in May, 1976 (2 invididuals) and in September, 1978 (4 individuals).

Humpback Whales could occur anywhere in the inside waters of Washington but the chance of more than a few stragglers occurring is slight.

Right Whale

The Right Whale occurs in both coastal and offshore waters. In the eastern North Pacific Ocean this species occurs north of Washington waters in summer and ranges from Washington south in winter. The North Pacific population is thought to be perhaps 200 individuals.

The most recent sighting of this species in Washington waters was made on 17 January 1976 when 3 were observed 15 miles WSW of Cape Flattery. The Right Whale has never been reported from the Strait of Juan de Fuca or other inside waters of Washington.

Fin Whale

The Fin Whale is an offshore inhabitant. In the eastern North Pacific Ocean it ranges from the Arctic south to California in summer and to tropical waters in winter. In the North Pacific this species is presently estimated to number about 17,000 animals. One Fin Whale was pursued in Puget Sound in 1915 and another in August, 1930, although the 1930 specimen may have been a young Blue Whale based on recent examination of photographs. No new sightings have been reported for this species in the Strait of Juan de Fuca or other inside waters of Washington.

Since it is an offshore species, the presence of a Fin Whale inside waters of Washington would certainly represent an accidental straying away from its normal range.

Sei Whale

The Sei Whale is an inhabitant of offshore waters. In the eastern North Pacific Ocean it ranges from the Gulf of Alaska south to California in summer and occurs in tropical waters in winter. The population in the North Pacific is presently estimated to be about 9,000 animals.

There are no records of this species from the Strait of Juan de Fuca or other inside waters of Washington.

Sperm Whale

The Sperm Whale is an inhabitant of offshore waters. In the eastern Pacific mature males range north to the Bering Sea in summer, with females and immature animals being found south of 50° north latitude; the species ranges south into tropical waters. The current population estimate for the North Pacific is 376,000

There are no records of this species occurring in the Strait of Juan de Fuca or the inside waters of Washington.

Leatherback Sea Turtle

The Leatherback Sea Turtle is an inhabitant of offshore waters. In the eastern North Pacific it ranges north to the Gulf of Alaska. There are two records from Alaska, one was taken in a salmon seiner's net and one was taken near Craig, Southeastern Alaska, also in a seiner's net on 21 August 1978. Its population is unknown.

None have been reported from the Strait of Juan de Fuca or the inside waters of Washington.

National Marine Mammal Laboratory, NWAFC
7600 Sand Point Way N.E.
Seattle, Washington 98115

February 19, 1980
(Revised April 30, 1984)

NPSEN-PL-ER 29 January 1987

PUGET SOUND DREDGED DISPOSAL ANALYSIS
BIOLOGICAL ASSESSMENT ON BALD EAGLE
FOR THE PHASE I AREA (CENTRAL PUGET SOUND)

1. Background. The Puget Sound Dredged Disposal Analysis (PSDDA) is a program for the management of unconfined, open-water disposal of dredged material in waters of Puget Sound. The program includes: (1) designation of acceptable disposal sites, (2) definition of dredged material evaluation procedures, and (3) disposal site management plans.

Recently there has been heightened public and agency concern over the long-term environmental health of Puget Sound and the role dredged material played in perceived water and sediment quality problems. Questions have been raised over project-by-project dredged material evaluation processes, and some felt that the existing public disposal sites were not at the "best" locations. Due to expiring local shoreline master program permits, by July 1987, only one of the three central Puget Sound existing unconfined, open-water disposal sites will remain open. That site is permitted only to June 1988. This condition creates uncertainty with regard to future disposal of dredged material and highlights the urgency of having an acceptable dredged material disposal program. A proposed program has been developed through a special Federal-state cooperative study.

The U.S. Army Corps of Engineers (Corps), U.S. Environmental Protection Agency (EPA), Washington Department of Natural Resources (DNR), and Washington Department of Ecology (Ecology) began the PSDDA study in April 1985. The study is a 3-year-long effort being conducted in two overlapping phases, each 2 years in length. Phase I covers central Puget Sound, including the sound's major urban centers, Tacoma, Seattle, and Everett (see figure 1). Phase II, initiated in April 1986, covers the north and south Sound area, including Olympia, Port Angeles, and Bellingham.

The goal of PSDDA is to provide environmentally safe and publicly acceptable guidelines governing unconfined, open-water disposal of dredged material, thereby improving consistency and predictability in the decisionmaking process.

The Corps is the lead Federal agency for this study and as such has responsibility for meeting the requirements of section 7 of the Endangered Species Act of 1973, as amended (Public Law 97-304). The bald eagle (*Haliaeetus leucocephalus*) was the only species included in the Fish and Wildlife Service letter of December 17, 1986, which listed all species on the Federal List of Endangered and Threatened Wildlife and Plants that are found near Puget Sound and potentially affected by the study. This biological assessment (BA) evaluates the alternate unconfined open-water disposal sites considered by PSDDA for central Puget Sound (see paragraph 2 for description) for possible impacts to this species.

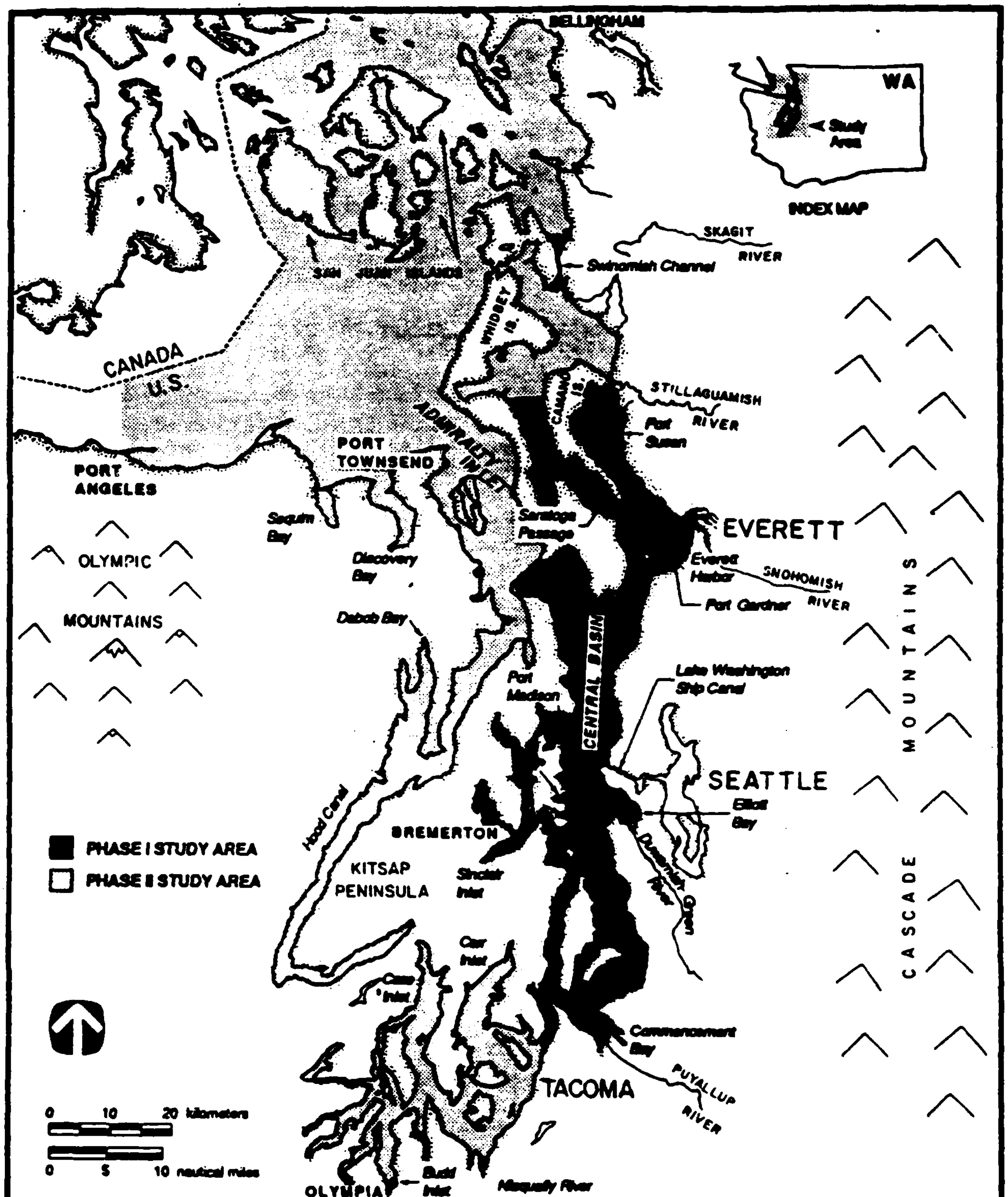

Figure 1. Puget Sound, Washington

2. Project Description.

a. General. Three public multiuser unconfined, open-water disposal sites have been identified which will partially meet the future dredged material disposal needs of the Phase I area. More than 50 percent of future dredged material is expected to be found unsuitable for this disposal option and will need to be confined in aquatic capped, nearshore, or upland facilities. A preferred unconfined, open-water disposal site has been located in each of the Tacoma, Seattle, and Everett urban embayments of Commencement Bay, Elliott Bay, and Port Gardner, respectively. The sites, while varying in size primarily due to bathymetry, average about 350 acres in potential bottom impact area. Each site includes a 900-foot radius, 58-acre surface disposal zone within which all dredged material must be released. See figure 2 for the location of the preferred and alternative sites.

The preferred disposal sites are all located to avoid areas with important biological resources and human use activities. The center of the Commencement Bay preferred disposal zone is located approximately 1 mile west of Browns Point in water about 530 feet deep. In Elliott Bay, the center of the preferred disposal zone is located about 3/4 of a mile north of Harbor Island in water 265 feet deep. The center of the Port Gardner preferred disposal zone is located about 2-1/4 miles southeast of Gedney Island in approximately 420 feet of water.

b. Site Selection Process. The PSDDA site selection process utilized existing information in combination with field studies to identify preferred and alternative disposal sites. The approach used is similar to that described in the EPA and COE workbook entitled "General Approach to Designation of Studies for Ocean Dredged Material Disposal Sites" (EPA, 1984). Steps of the site selection process were as follows:

(1) Define general siting philosophy. (This step addresses disposal philosophy (i.e., whether sites should be dispersive or nondispersive), general siting locations (i.e., ocean, strait, or sound), and number of disposal sites.)

(2) Identify selection factors to delineate Zones of Siting Feasibility (ZSF's). (This step uses existing information on biological resources and human use activities to identify general areas where disposal sites might be appropriately located.)

(3) Conduct field studies on the ZSF's. (Field and model studies are conducted to fill key data gaps and gather information on the physical and biological conditions of the ZSF's. Since these studies were conducted to check the general condition of the ZSF's, they are sometimes referred to as "checking studies.")

(4) Identify preliminary sites within the ZSF's. (Information from the ZSF studies is used to identify preliminary locations for disposal sites within the ZSF's.)

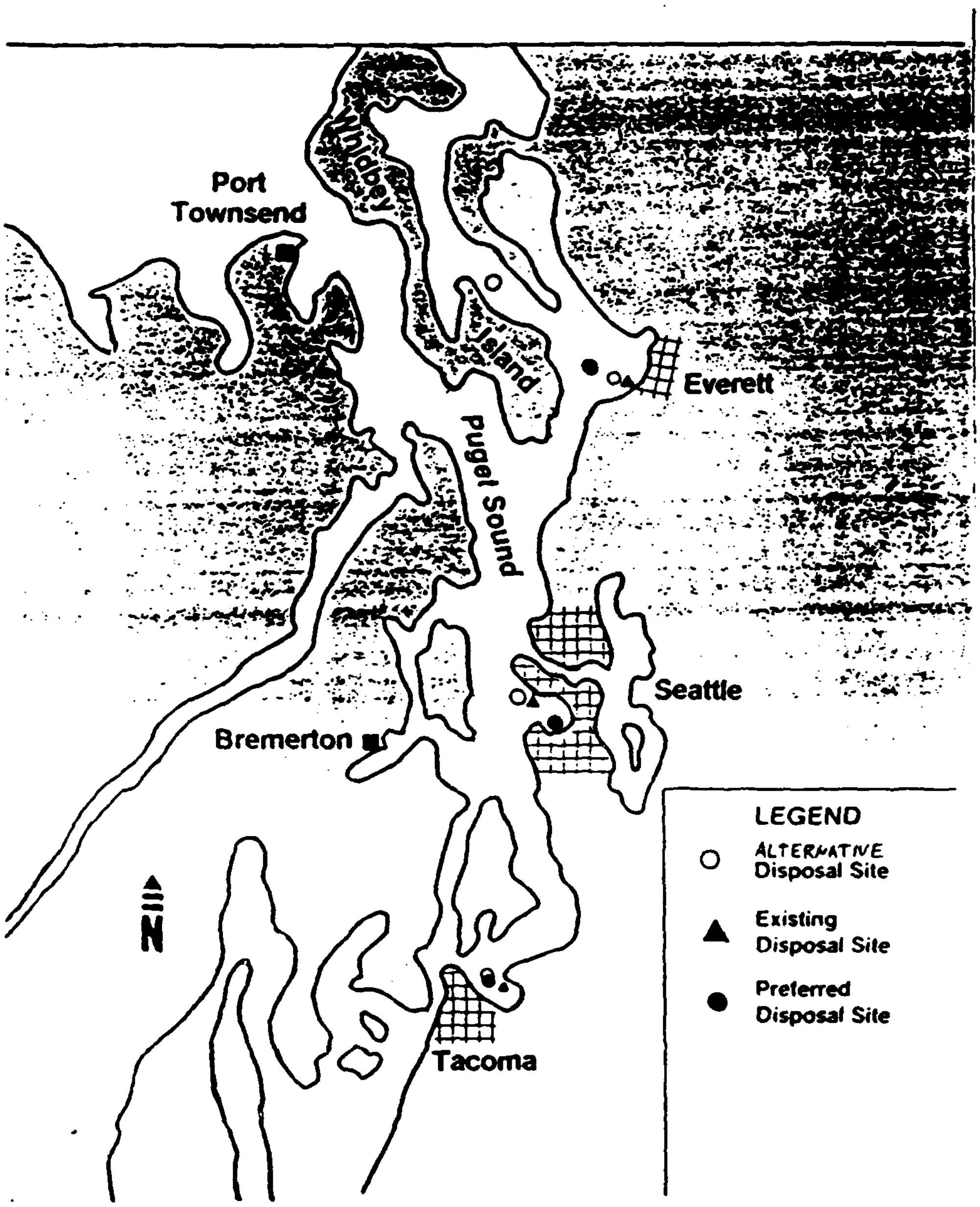

Figure 2 Disposal Site Locations, Phase I Area

(5) Conduct field studies on the sites. (Field and model studies are conducted to obtain needed physical and biological information for the preliminary sites. These studies are referred to as "site-specific studies.")

(6) Identify preferred sites. (Information from the site-specific studies is used to identify preferred and alternative sites.)

Existing DNR disposal sites were considered in the disposal site selection process if they met site selection factors discussed below. All cooperating agencies in PSDDA agreed early on that no special a priori consideration would be given to the existing sites, because of human use conflicts and environmental concerns with past dredging and disposal protocols. An objective site selection process was used to minimize environmental and human usage conflicts as much as possible, and existing sites adequately meeting the site selection factors and constraints were given equal consideration with other potential sites.

Early in the PSDDA study it was determined that open-water unconfined disposal sites in the Phase I area should be relatively nondispersive rather than dispersive in nature. Placing dredged material in nondispersive sites gives site managers the ability to maintain control and accountability over site conditions. This is particularly important when chemical contaminants may be present in the dredged material and it is necessary to minimize the exposure of important resources.

c. General ZSF Selection Factors. Three general ZSF selection factors were identifid early in the PSDDA study. It was determined that ZSFs should, to the maximum extent possible:

First, avoid high energy areas that would disperse dredged material significantly beyond the disposal site area.

Second, avoid significant adverse impacts on foodfish, shellfish, marine mammals, and marine birds.

And third, minimize interference with human uses to the lowest practicable level.

d. Specific ZSF Selection Factors. The three general ZSF selection factors were further defined by nineteen specific selection factors (shown in table 1). Most of these factors are identified in Federal and State regulations relating to dredged material disposal sites located in water.
The specific factors were mapped and overlayed to display areas where siting might occur with a minimum of conflict.

TABLE 1

SPECIFIC FACTORS FOR IDENTIFICATION OF
ZONES OF SITING FEASIBILITY

1. Navigation activities
2. Recreational uses
3. Cultural sites
4. Aquaculture facilities
5. Utilities
6. Scientific study areas
7. Point pollution sources
8. Water intakes
9. Shoreline land use designations
10. Political boundaries
11. Location of dredging areas
12. Beneficial uses of dredged material
13. Fish/shellfish harvest areas
14. Threatened and endangered species
15. Fish/shellfish habitat
16. Wetlands, mudflats and vegetated shallows
17. Bathymetry
18. Sediment characteristics
19. Water currents

e. Site in Commencement Bay Area. The preferred site in the Commencement Bay ZSF was identified based on results of ZSF and site-specific studies.

(1) Commencement Bay Preferred Site. The center of the Commencement Bay preferred site is located at Latitude 47d 18.22m and Longitude 122d 27.84m and lies approximately 1 mile west of Browns Point (figure 3). The center of the existing DNR disposal site is located 1.2 nautical miles southeast of the preferred site, with the northwestern edge of the site only 230 yards from the preferred site boudary. The preferred site is elliptical in shape, covering approximately 310 acres, with a long axis of 4,600 feet oriented parallel to the tidal current flood-ebb direction and short axis of 3,800 feet. The bottom slope at this site is approximately 1-foot vertical to 200 feet of horizontal distance, which is essentially flat. The proposed site lies in an area where sediments tend to deposit rather than erode, as suggested by clay composition exceeding 15 percent, water content exceeding 50 percent, volatile solids exceeding 4 percent, and biochemical oxygen demand exceeding 500 (data summary from Depositional Analysis). The small grain size (i.e., medium silt) suggests that current speeds lie below the 25 centimeter per second threshold; and are backed up by numerical model results suggesting peak speeds of 18-20 centimeters per second. At this current speed dredged materials disposed should not be resuspended by local currents. Net current direction appears to be toward the southwest and the site is oriented accordingly.

COMMENCEMENT BAY

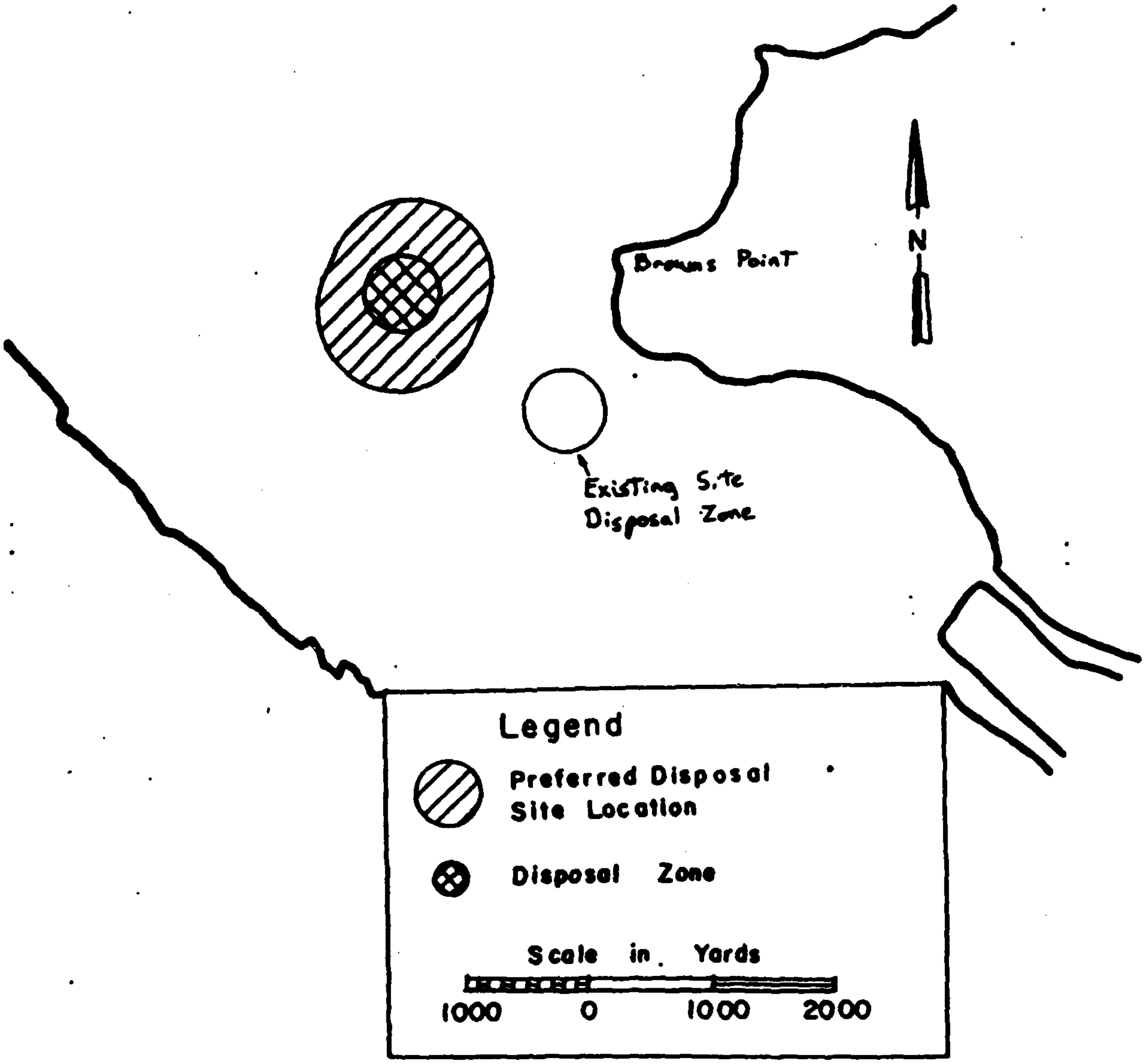

Figure 3 Commencement Bay Disposal Site

f. Site in Elliott Bay Area. The preferred site for the Elliott Bay ZSF was identified based on results of ZSF and site-specific studies.

(1) Elliott Bay Preferred Site. The center of the preferred site in Elliott Bay is located at Latitude 47d 36.03m and Longitude 122d 21.34m within the confines of a depositional area near the mouth of the Duwamish River (figure 4). The disposal site is shaped like a large egg with the south end of the site located in approximately 200 feet of water and the north end of the site located in approximately 360 feet of water. The site is approximately 6,200 feet in length and 4,000 feet wide, covering 415 acres. The site is located in a submarine valley with relatively steep sides and a downward slope ranging from 1:30 to 1:50.

g. Site in the Port Gardner Area. The preferred site for the Port Gardner ZSF was identified based on results of ZSF and site-specific studies.

(1) Port Gardner Preferred Site. The center of the preferred Port Gardner site is located at Latitude 47d 58.86m and Longitude 122d 16.67m, and lies approximately two nautical miles west of Everett Harbor (figure 5). The 318-acre site is circular and located in 420 feet of water on a large flat plane with a diameter of 4,200 feet. Bottom slopes are less than 1 feet vertical on 200 feet horizontal. Because bottom slope and tidal currents should not significantly alter the disposal site configuration, the delineated site is a 4,000-foot-diameter circle that is concentric with the 1,800-foot-diameter drop zone.

3. Methods. Individuals knowledgeable of bald eagles in the Puget Sound area were contacted and interviewed. Available literature was reviewed and pertinent information was used in this assessment. References are listed at the end of this assessment.

4. Expected Impacts of PSDDA on Bald Eagles. This section is organized into three major subheadings: Description of the (general) Puget Sound Environment; Use of Puget Sound Habitat by Bald Eagles; and Potential Impacts to Bald Eagles from Implementation of PSDDA. The second subheading is further broken down to: General; Commencement Bay; Elliott Bay; and Port Gardner.

a. Description of the Environment. Puget Sound is an inland arm of the Pacific Ocean that connects to the Pacific through the Strait of Juan de Fuca. Puget Sound is broadly described as a large basin consisting of a complex system of interconnecting subbasins (formed primarily by the retreat of ice sheets that covered the area until about 10,000 years ago). Puget Sound is modified and enriched by the supply of large volumes of fresh water resulting from precipitation, over 2,500 lakes and ponds (totalling 175 square miles), and over 10,000 rivers and streams ultimately flowing into Puget Sound. A critical result of freshwater streams entering marine waters is the creation of estuaries. Estuaries are characterized by the action of pumping large volumes of fresh and marine water back and forth, primarily as a result of tides. The pumping action also promotes mixing of fresh and marine waters,

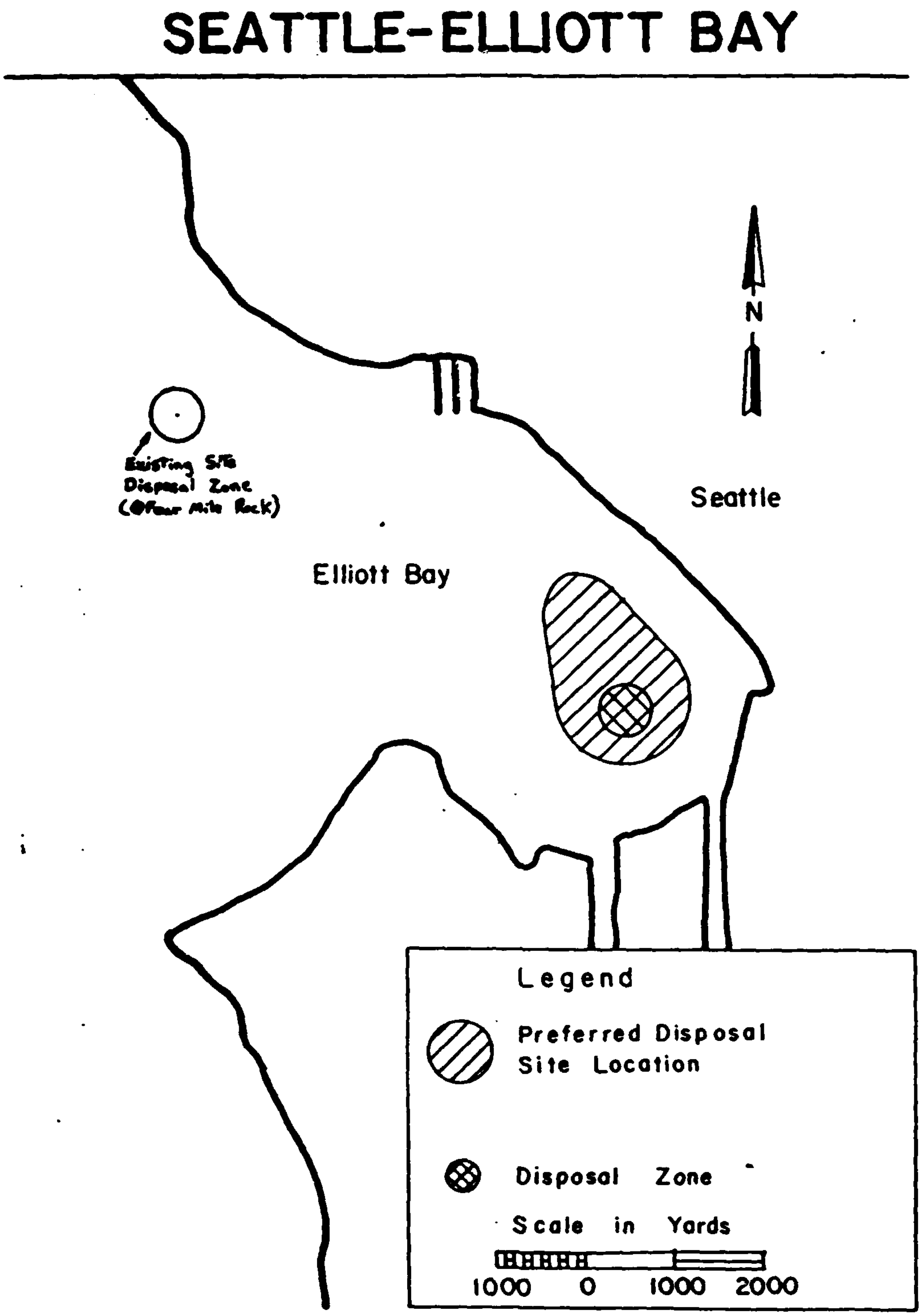

Figure 4 Ellitt Bay Disposal Site

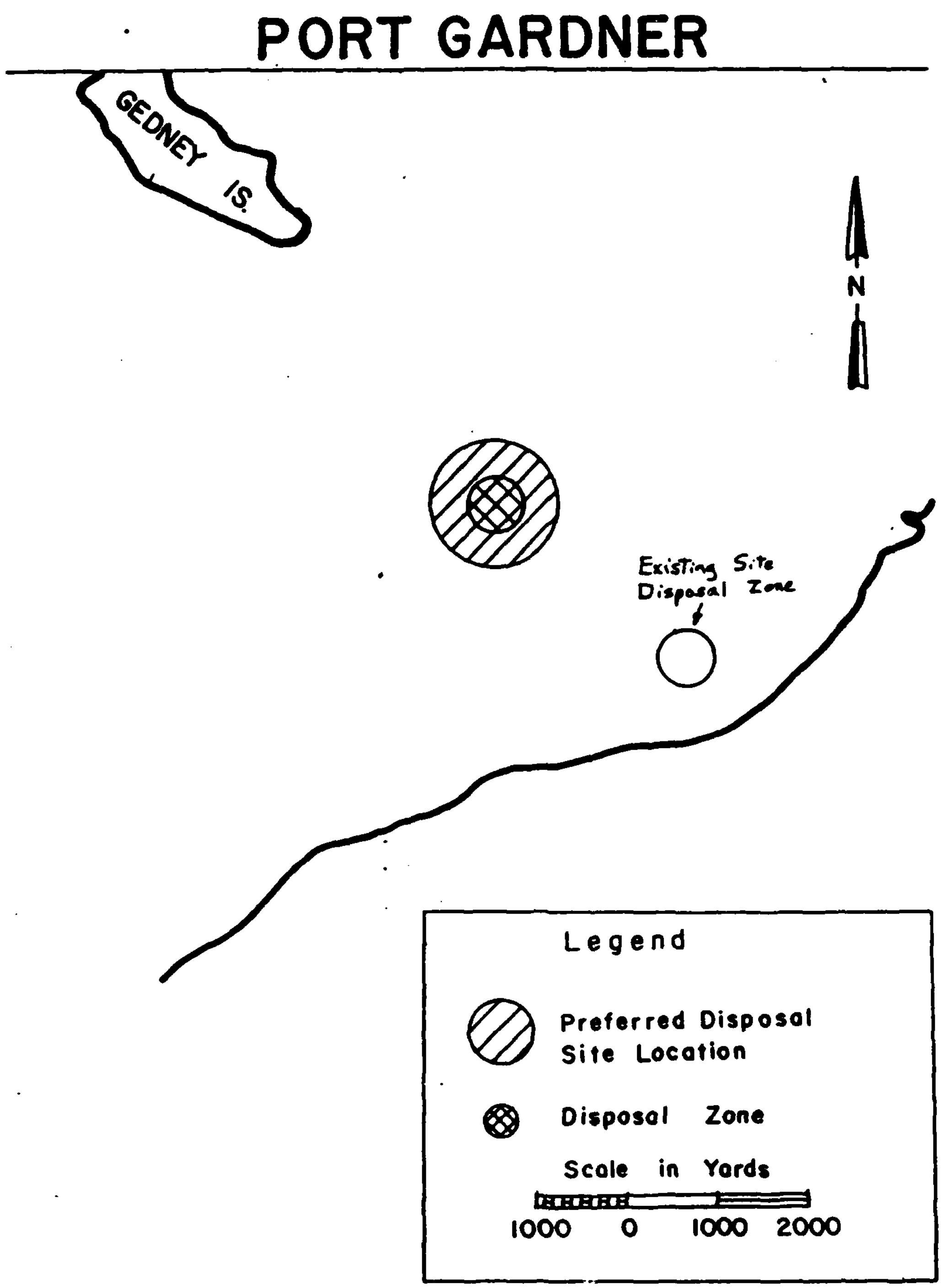

Figure 5 Port Gardner Disposal Site

diluting the salinity of the marine water, but, more importantly, resulting in exchange of nutrients between the marine and freshwater systems. Estuaries are thus very productive (biologically), and rich in plant and animal life. The mouths of streams are also located in low elevation land areas with shallow gradients, which are often sites of wetlands, which greatly add to the diversity and productivity of the Puget Sound basin. Thus, the Puget sound basin is a mixture of land masses (with their associated terrestrial and wetland habitats), rivers and lakes, estuaries, and open water marine environments. Bald eagles utilize and depend on each of these environments for their survival. The focus of the BA will be on PSDDA's effects on the marine environment, and to a lesser extent, estuarine environment, and the resultant effects on bald eagles.

b. Use of Puget Sound Habitats by Bald Eagles.

(1) General. Bald eagles are present throughout the year in the Puget Sound basin, and nest along the coastline of the sound. The bald eagle is relatively uncommon, and nests essentially thoughout the basin where large trees (usually Douglas firs, western red cedars, and western hemlocks) are present. Bald eagles also winter throughout the basin, but are most common along streams that support salmon runs, where the eagles feed on spawned-out salmon. This may be as much as 50 miles upstream, as on the Skagit River. It is well known that bald eagles are opportunistic, feeding on whatever dead prey may appear, including fish, waterfowl, and mammals. Bald eagles also will pursue and capture live birds and fish swimming close to the surface. Bird species taken are usually waterfowl, but may also include gulls (Hayward, et al., 1977; Richter, 1984; Leschner, 1984). The author observed an adult bald eagle take a male bufflehead off the surface of Padilla Bay from amongst a large flock of waterfowl, in February, 1983.

During the winter, bald eagles roost communally, usually in an area of coniferous trees. No communal roosts are known to the author or Washington Department of Game (WDG) in the vicinity of central Puget Sound (Leschner, 1987; MacAllister, 1987).

(2) Commencement Bay. A pair of bald eagles maintain an active nest in Point Defiance Park. This is the only bald eagle nest within several miles of the proposed disposal site. Bald eagles are present year round in the vicinity of Commencement Bay. The abundance of open water, prey base, and forested cliffs all contribute to good quality bald eagle habitat in this area. The prey base is assumed to consist primarily of waterfowl, which are relatively abundant in and around Commencement Bay, especially during migration and winter months.

Point Defiance Park provides innumerable perches from which to hunt, eat, rest, or roost. The presence of thousands of park visitors, however, limits the areas where bald eagles can perch and nest without disturbance.

During the winter months, it appears from Mid-Winter Bald Eagle Census results that between 2 to 7 bald eagles may winter in the vicinity of Tacoma, including Anderson and McNeil Islands.

(3) Elliott Bay. According to the December 17, 1986 list of the FWS, bald eagles are not found in the vicinity of the proposed deepwater disposal site in Elliott Bay, and would not be impacted by disposal in Elliott Bay.

(4) Port Gardner. Bald eagles nest along Pigeon Creek 2 miles south of the Port of Everett. They also nest at seven other locations (12 nests in all) within ten miles of the proposed disposal site (FWS, 1986). Of these other nests, three are about 5 miles from the disposal site, and one is about 2 miles from the site. During the breeding season (particularly April through September), it appears that numbers of waterfowl are not sufficient to support such a large nesting population of eagles. Therefore, the author assumes, lacking concrete evidence to the contrary, that these nesting pairs rely primarily on surface-swimming fish during the spring and summer. During migration and winter, waterfowl numbers (especially mallards and American wigeons) increase dramatically. Bald eagles very likely shift their hunting behavior to take more waterfowl during migration and winter.

During the winter months bald eagles in this vicinity appear to shift inland, primarily along rivers, where they are attracted by spawning salmon. Snohomish, Skykomish, and Snoqualmie Rivers are the major wintering rivers for bald eagles in Snohomish County (WDG, 1980). Port Susan Bay also recieves regular use by bald eagles, attracting between 6 and 13 birds on the Mid-Winter Bald Eagle Census.

c. Impacts to Bald Eagles.

(1) General. Bald eagles are present throughout the year near the Commencement Bay and Port Gardner disposal areas. They feed on whatever may be present (ducks, gulls, live surface-swimming fish, dead animals washed ashore, ets.). Concentrations of birds or fish are helpful for prey-capture success. Relatively large animal concentrations are located near the disposal areas, but are not located at the proposed disposal sites themselves. This is a direct result of PSDDA planning, which has endeavored to select deepwater disposal sites that result in minimal environmental impacts and minimal human use conflicts. Although concentrations of birds and fish are not expected to be affected by PSDDA disposal sites, a small percentage of animals would likely suffer some effects. The only potential direct impacts of deepwater disposal on waterbirds and fish would appear to be the result of short-term turbidity, temporary loss of prey source, and potential impacts to intertidal organisms from drift of fine-grained disposed material. Turbidity limits visibility and makes feeding difficult. Fortunately, turbidity is localized and temporary; furthermore, waterbirds will avoid the turbidity plume and feed elsewhere. Newly disposed material may cover the bottom to several feet deep, thus burying some of the organisims that may be living in the substrate. However, at the preferred disposal sites the bottom is at least 250 feet below

the surface. Few birds dive this deep (cormorants and loons may), which limits the impacts to a few species, none of which are regularly preyed upon by bald eagles. Finally, even if the disposal areas do not recolonize as expected (probably because intervals between disposal operations would be too short to allow animals to recolonize), the total area of impact is small relative to the potential feeding area in Puget Sound. Waterbirds and fish are mobile; also, the sites selected will have low biological productivity prior to disposal, such that the loss would be minimal. The potential loss of intertidal organisms from drift of disposed material is considered to be minimal and will not affect waterbirds or fish. Finally, any and all materials disposed of in deep water will be pretested for contaminants and toxics. Only suitable material will be disposed in deep water; all other material will be disposed at special confined sites. Thus, animals are not expected to be affected by contaminants. Since the bald eagle prey base would not be affected, bald eagles would not be affected from the standpoint of food source.

Other potential effects associated with the disposal areas primarily include human disturbance and noise from disposal barges. The most important consideration is that potential disposal sites will be away from regular areas of animal use. Thus, human disturbance and noise are not expected to affect any endangered species.

None of the proposed disposal sites have unique features that vary from the above discussion. Therefore, the disposal sites are not discussed separately.

5. Conclusions and Summary. PSDDA is a comprehensive, coordinated effort to select environmentally safe unconfined open-water disposal sites, and properly manage the use of those sites. Implicit in the PSDDA process is that sites selected would be those that would avoid animal concentration areas as well as human activities and would therefore result in minimal adverse environmental impacts. Analysis of known distributions of waterfowl and fish indicate that use of preferred alternative sites selected for Phase I area dredged material disposal will not impact bald eagles in any way.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Olympia Field Office
2625 Parkmont Lane SW, B-3
Olympia, Washington 98502
206/753-9444 FTS 434-9444

December 17, 1986

Re: 1-3-87-SP-[61-64]

Mr. R.P. Sellevold
Chief, Engineering Division
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Sellevold:

As requested by your letter, dated November 12, 1986 and received by us on November 14, 1986, I have attached a list of endangered and threatened species (Attachment A) that may be present in the area of the proposed inwater Puget Sound dredged disposal sites near Tacoma, Seattle, Everett and Saratoga Passage. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended. The requirements for Corps compliance under the Act are outlined in Attachment B.

Should the biological assessment determine that a listed species is likely to be affected (adversely or beneficially) by the project, the Corps should request formal Section 7 consultation through this office. Even if the biological assessment shows a "no effect" situation, we would appreciate receiving a copy for our information.

Your interest in endangered species is appreciated. If you have any additional questions regarding your responsibilities under the Act, please contact Jim Michaels at the above phone/address.

Sincerely,

Lynn P. Childers

Lynn P. Childers
Acting Field Supervisor

Attachments

c: WDG (Nongame)
WNHP

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED INWATER DREDGED DISPOSAL SITE NEAR TACOMA, PIERCE COUNTY, WA

1-3-87-SP-61

LISTED

Bald eagle (Haliaeetus leucocephalus) - A bald eagle nesting territory with two nests is located at T21N, R2E, S15. Nesting territories are occupied from about January 1 through August 15.

Major concerns that should be addressed in your biological assessment of project impacts to bald eagles are:

1. The effect of inwater disposal on the bald eagle's food supply.

2. The effect of the physical placement of dredged material that may result in the disturbance of bald eagles.

PROPOSED

None

CANDIDATE

None

Attachment A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED INWATER DREDGED DISPOSAL SITE NEAR SEATTLE, KING COUNTY, WA

1-3-87-SP-62

LISTED

None

PROPOSED

None

CANDIDATE

None

Attachment A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED INWATER DREDGED DISPOSAL SITE NEAR EVERETT, SNOHOMISH AND ISLAND COUNTIES, WASHINGTON

1-3-87-SP-63

LISTED

Bald eagle (Haliaeetus leucocephalus) - wintering bald eagles may occur in the vicinity of the project from about October 31 through March 31.

Bald eagle nesting territories located in the project area are occupied from about January 1 through August 15.

Snohomish County
T29N R4E S16 - Gedney Island
T29N R4E S25 (2 nests) - Pigeon Creek
T30N R4E S6 (2 nests) - Kayak Point
T30N R4E S36 - Tulalip Bay

Island County
T28N R3E S1 - Glendale
T29N R3E S11 - Langley
T30N R3E S24 - Tyee Beach
T30N R3E S24 - Soucam North
T30N R3E S25 - Camino Head
T30N R3E S25 - Camino Head West

Major concerns that should be addressed in your biological assessment of project impacts to bald eagles are:

1. The effect of inwater disposal on the bald eagle's food supply.

2. The effect of the physical placement of dredged material that may result in the disburbance of bald eagles.

PROPOSED

None

CANDIDATE

None

Attachment A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED INWATER DREDGED DISPOSAL SITE NEAR SARATOGA PASSAGE, ISLAND COUNTY, WASHINGTON

1-3-87-SP-64

LISTED

Bald eagle (Haliaeetus leucocephalus) - wintering bald eagles may occur in the vicinity of the project from about October 31 through March 31.

Major concerns that should be addressed in your biological assessment of project impacts to bald eagles are:

1. The effect of inwater disposal on the bald eagle's food supply.

2. The effect of the physical placement of dredged material that may result in the disturbance of bald eagles.

PROPOSED

None

CANDIDATE

None

Attachment A

EXHIBIT B

FEDERAL ADVANCE IDENTIFICATION OF
DISPOSAL SITES, 40 CFR 230.80

July 15, 1988

EPA

PUBLIC NOTICE

FINAL DETERMINATION OF SUITABILITY FOR DISPOSAL OF DREDGED MATERIAL IN WATERS OF CENTRAL PUGET SOUND

1. On May 6, 1986, the U.S. Environmental Protection Agency, Region 10, Seattle, Washington, and the Seattle District, U.S. Army Corps of Engineers (Corps), issued a Public Notice to initiate the Advanced Identification of sites in central Puget Sound suitable for disposal of dredged material under Subpart I of the Section 404(b)(1) Guidelines of the Clean Water Act, as described at 40 CFR 230.80. A multiagency study of alternative potential disposal sites and alternative biological effects levels for site condition management was undertaken by the Corps; Region 10, U.S. Environmental Protection Agency (EPA); and the Washington Departments of Ecology and Natural Resources. This effort is known as the Puget Sound Dredged Disposal Analysis (PSDDA). The PSDDA study, which began in April 1985, is being conducted in two 3-year-long overlapping phases. Phase I deals with the central region (Everett, Seattle, and Tacoma), and Phase II covers the balance of the sound (see figure 1).

2. In January 1988, the Corps issued a Draft Proposed Management Plan (DPMP) and Draft Environmental Impact Statement (DEIS) for the Phase I study area, pursuant to the National Environmental Policy Act (NEPA), identifying the preferred alternative unconfined open-water disposal sites and preferred site management condition. A Proposed Determination of Suitability was issued in January, 1988, in conjunction with the DEIS. Public comments on these documents were solicited through March, 1988. A Final Environmental Impact Statement (FEIS) and Management Plan Report (MPR), incorporating responses to these comments, are being published concurrently with this Public Notice. These documents, including technical appendixes, provide the basis for this final determination of suitability.

3. The preferred sites are considered suitable for the disposal of dredged material found acceptable for unconfined open-water disposal per the Section 404(b)(1) Guidelines (see 4 below). These sites are located within Tacoma, Seattle, and Everett major urban embayments: Commencement Bay, Elliott Bay, and Port Gardner, respectively, as shown in figure 2. The waters of the Phase I area extend north from the Tacoma Narrows Bridge to Foulweather Bluff/Double Bluff and north up Saratoga Passage to the community of Camano.

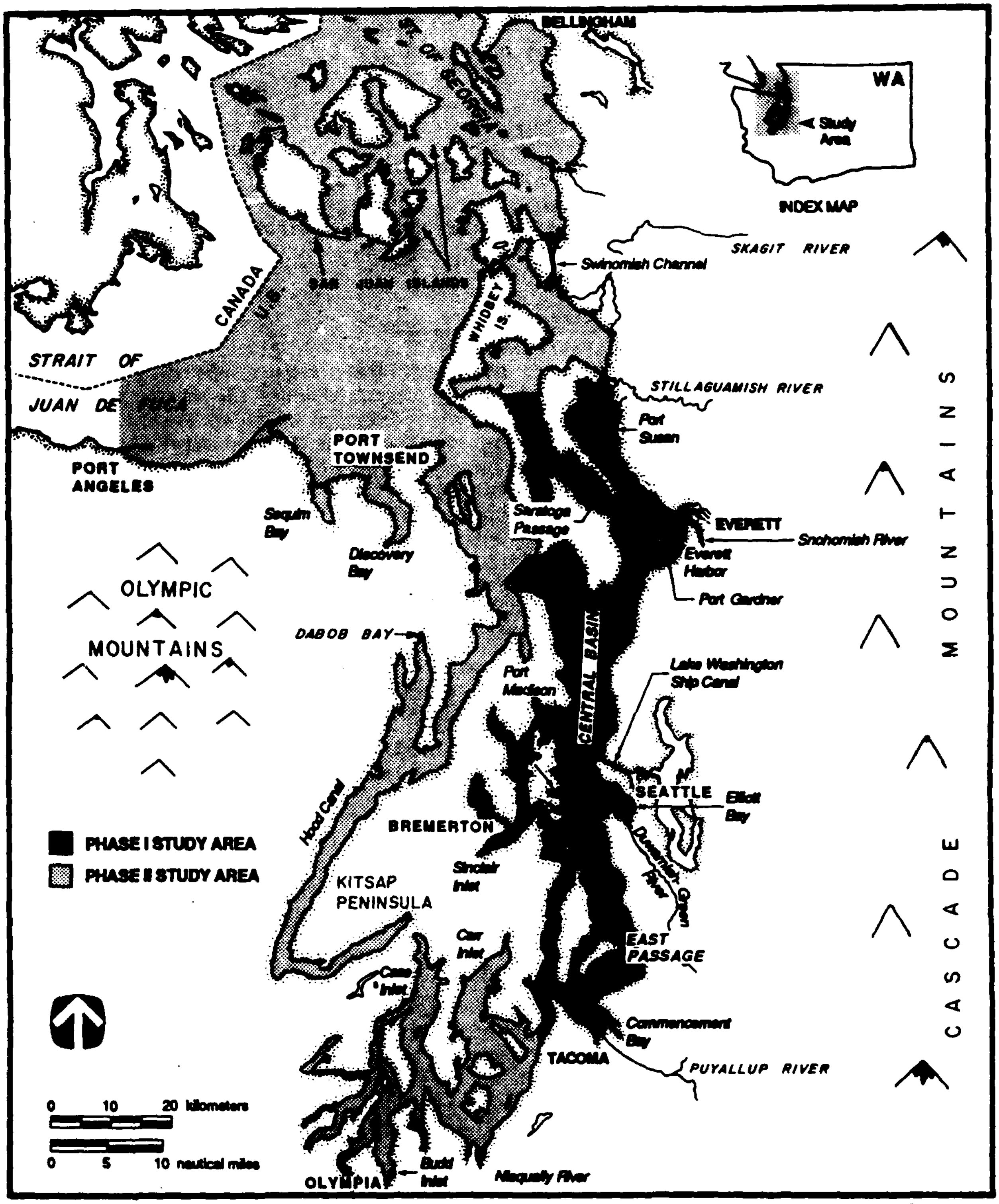

Figure 1: Puget Sound, Washington
Puget Sound Dredged Disposal Analysis Study Area

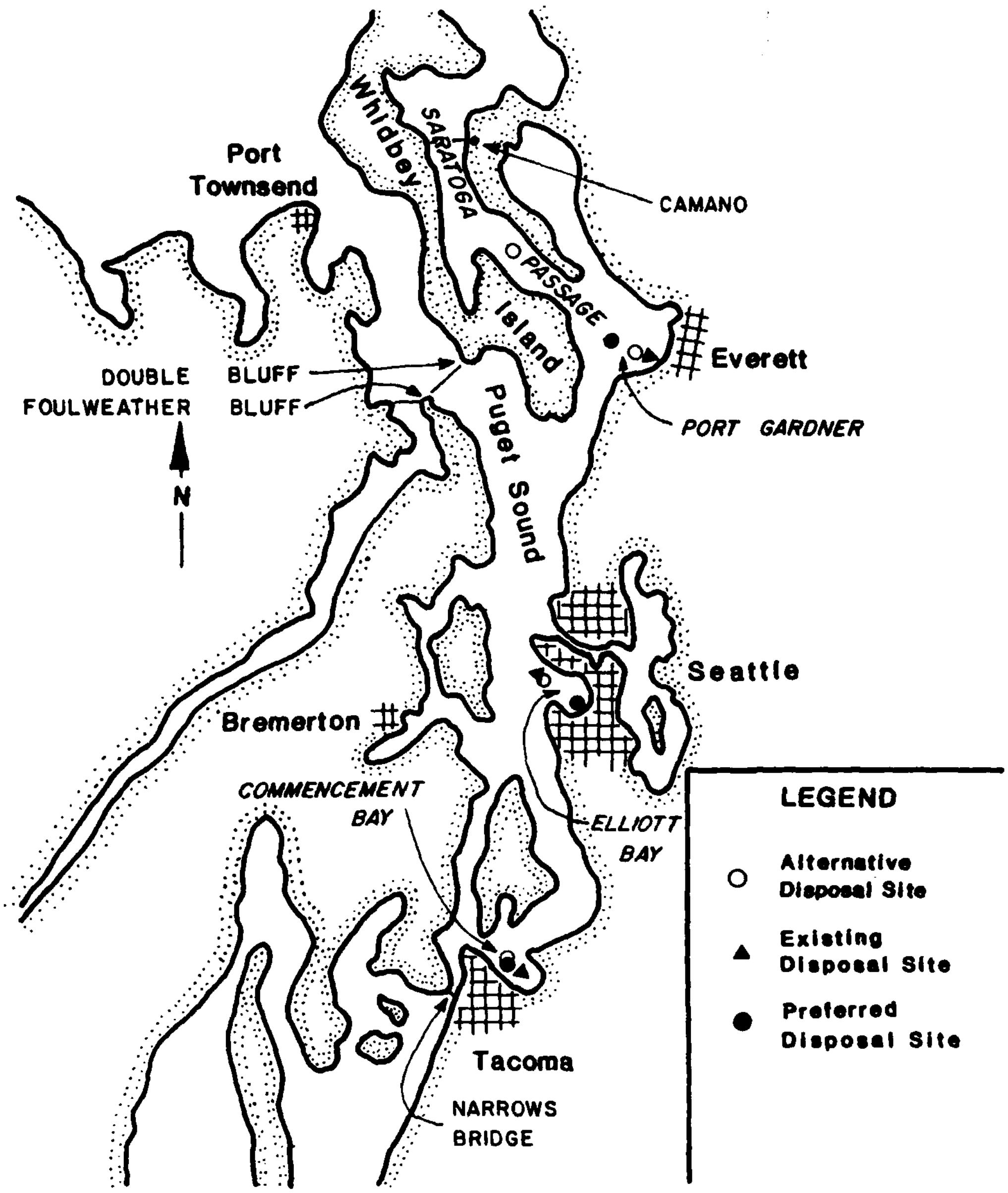

Figure 2: Phase I Study Area (Central Puget Sound) Disposal Sites

Commencement Bay. The center of the disposal zone of this site (latitude 47°18.22" longitude 122°27.84") is located approximately 1 mile west of Browns Point (see figure 3) and approximately 0.9 mile northwest of the center of the existing dredged material disposal site managed by the Washington Department of Natural Resources (DNR). The site varies in depth from 540 to 560 feet and covers an area of approximately 310 acres. The bottom slope at the site is relatively flat.

Elliott Bay. The center of the disposal zone of this site (latitude 47°35.97" longitude 122°21.38") is located in a low current area about 1 mile off the mouth of the Duwamish River and approximately 3 miles southeast of the center of the existing DNR Elliott Bay Fourmile Rock dredged material disposal site (see figure 4). The 415-acre site is egg shaped. The south and the north edges of the site lie in 200 and 360 feet of water, respectively.

Port Gardner. The center of the disposal zone of this site (latitude 47°58.86" longitude 122°16.67") is located approximately 3 miles west of Everett Harbor, 2.2 miles southeast of Gedney Island, and about 1.7 miles northwest of the center of the existing DNR Port Gardner dredged material disposal site (see figure 5). The disposal site covers about 318 acres. Water depth is approximately 420 feet, and the bottom slope is relatively flat.

4. Use of sites identified by EPA and the Corps as potentially suitable for discharge of dredged material will be conditioned to restrict the kind of discharge to be permitted when it is determined that the dredged material has characteristics which are likely to affect compliance with the 404(b)(1) Guidelines. The PSDDA study has indicated that minor adverse biological effects may be permitted at the preferred disposal sites as a condition of site management. Dredged material sampling and testing procedures that will be used to determine acceptability for disposal at these sites are described in detail in the MPR and accompanying technical appendixes.

5. The purpose of this public notice is to notify concerned citizens, the business community, agencies, and local governments of EPA's and the Corps' final determination of suitability for the three dredged material disposal sites referenced in paragraph 3 as sites deemed generally acceptable for the discharge of dredged material subject to the restrictions discussed in paragraph 4. This action will aid the Corps and EPA in making decisions on Section 404 permit applications involving future disposal of dredged material in central Puget Sound.

Dredged material may be discharged in areas identified as generally suitable for such activities provided the material fully complies with the Clean Water Act Section 404(b)(1) Guidelines and the discharge is approved through the Corps of Engineers' permit process. The identification of areas that are generally deemed suitable for disposal should not be regarded as a guarantee that permits to discharge dredged material in such areas will be issued. Instead, the identification process should assist a potential applicant in determining whether the requirements of the Section 404(b)(1) Guidelines will be met.

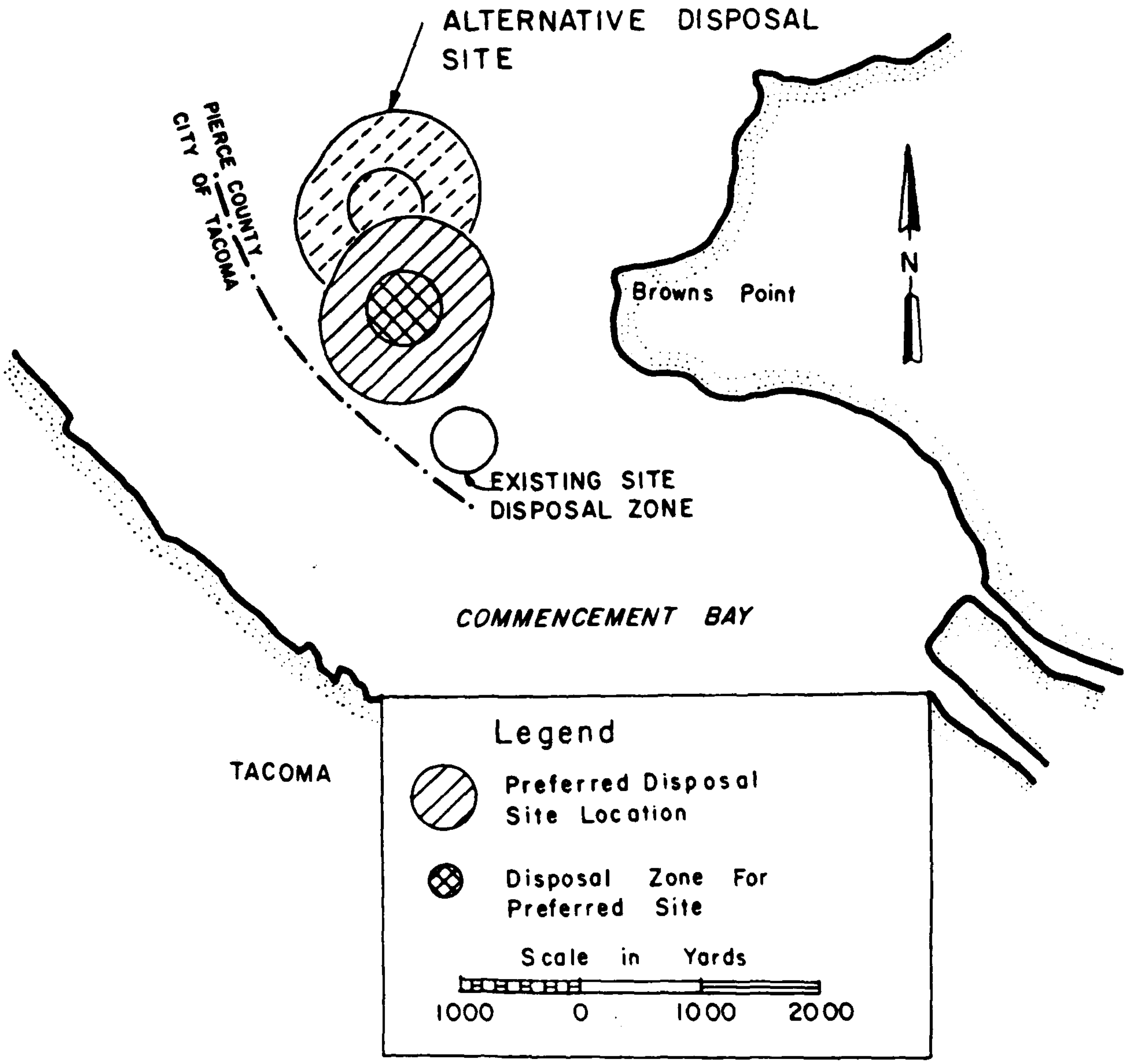

Figure 3: Commencement Bay
Unconfined Open-Water Dredged Material Disposal Sites

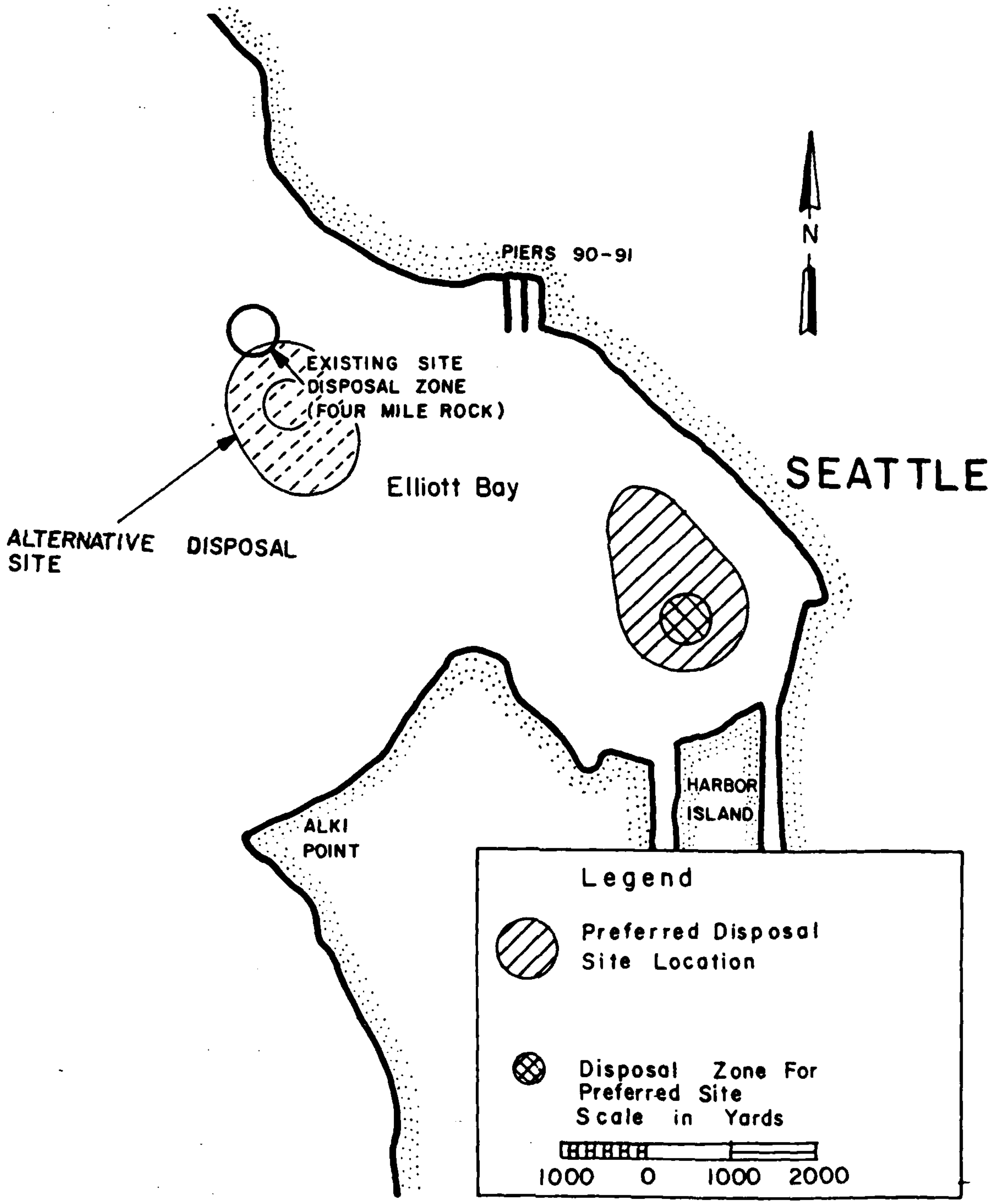

Figure 4: Elliott Bay
Unconfined Open-Water Dredged Material Disposal Sites

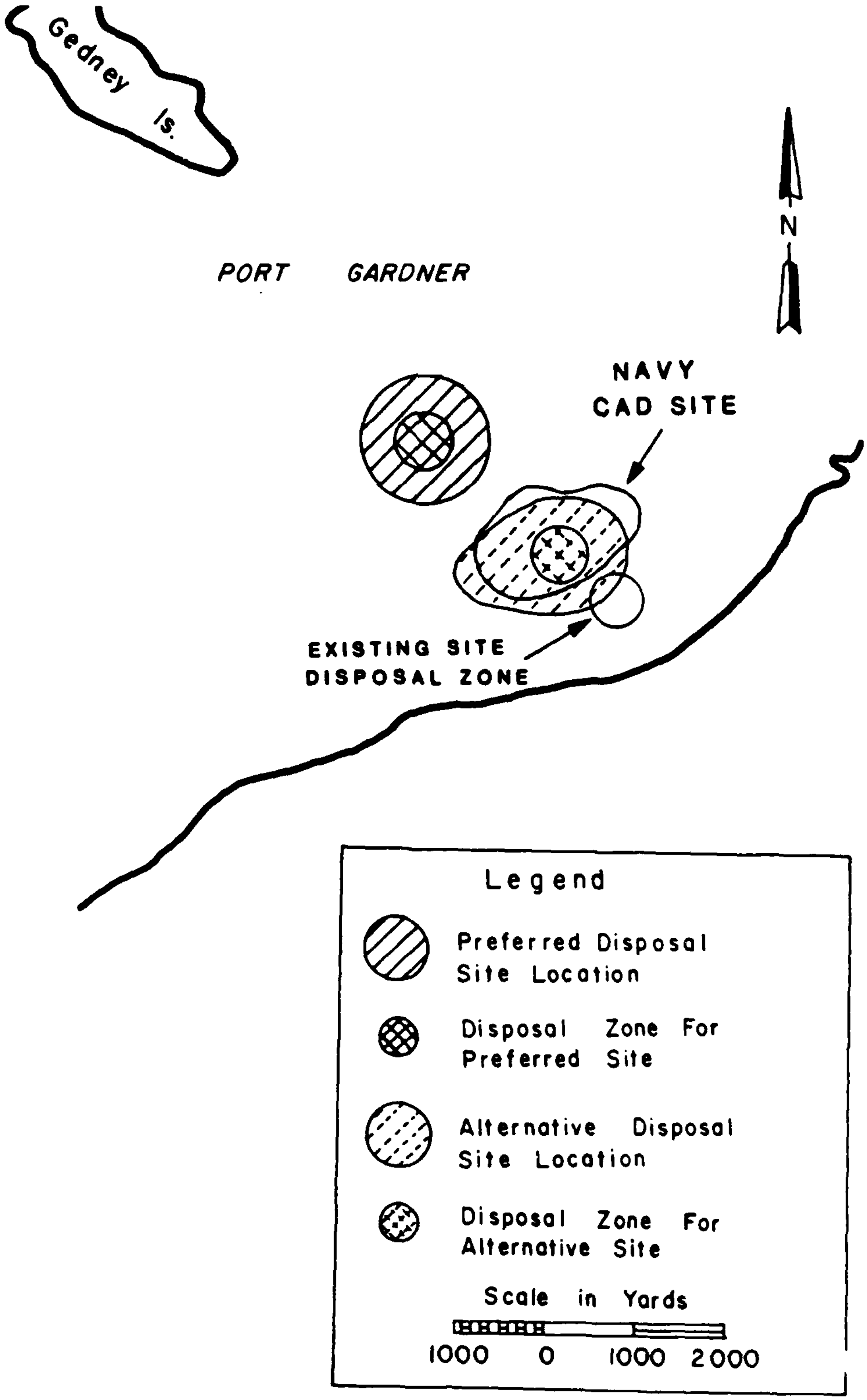

Figure 5: Port Gardner
Open-Water Dredged Material Disposal Sites (Unconfined & Confined)

6. The advanced site identification 230.80 process which began on May 6, 1986, will be completed at the time of issuance of the Record of Decision issued for PSDDA. Major 230.80 milestones are as follows:

° Initial joint EPA/Corps public notice	May 6, 1986
° Public comment period on initial public notice	May 6 through July 6, 1986
° Proposed determination of site suitability	January 15, 1988
° Public comment period	January 15, 1988 through March 1, 1988
° Public hearings	February 10, 1988 (Seattle) February 11, 1988 (Port Townsend)
° Final determination of suitability	(Published with FEIS) June 1988

7. Agencies and organizations consulted in this advanced identification effort include the following:

U.S. Environmental Protection Agency
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
U.S. Department of Commerce-National Marine Fisheries Service
U.S. Coast Guard
Washington Department of Natural Resources
Washington Department of Ecology
Washington Department of Fisheries
Washington Department of Wildlife
Washington Department of Social and Health Services
Washington Parks and Recreation Commission
Washington Department of Transportation
Puget Sound Water Quality Authority
City of Seattle
City Everett
City of Tacoma
Snohomish County
Pierce County
King County
Kitsap County
Port of Seattle

Port of Everett
Port of Tacoma
Port of Edmonds
Washington Public Ports Association
Municipality of Metropolitan Seattle
Puyallup Tribe
Muckelshoot Tribe
Suquamish Tribe
Tulalip Tribes
Puget Sound Alliance
Washington Environmental Council
Other cities, counties, ports, and Indian tribes located in Phase II study area

PHILIP L. HALL	ROBIE G. RUSSELL
Colonel, Corps of Engineers	Regional Administrator
District Engineer	U.S. Environmental Protection Agency
Seattle District	Region 10, Seattle

EXHIBIT C

PUBLIC COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) AND SUPPORTING DOCUMENTS; AND PSDDA AGENCY RESPONSES

PSDDA COMMENTS/PSDDA AGENCY RESPONSES

Comments on the Draft Environmental Impact Statement - Proposed Unconfined Open-Water Disposal Sites for Dredged Material, Phase 1 (Central Puget Sound) received during the February 10 and 11, 1988 public meetings; and in written form prior and subsequent to the public meetings are contained in this exhibit. Responses to comments generally appear directly alongside each comment. While the official 45-day public review period began on January 15, 1988 comments were received (and accepted) until March 30, 1988.

Comment letters and meeting testimony appear in the following order:

Local Agencies (con.)

Organizations

Private Individuals or Companies

Public Meeting Testimony - 2/10/88

Advisory Council On Historic Preservation

The Old Post Office Building
1100 Pennsylvania Avenue, NW, #809
Washington, DC 20004

Reply to: 730 Simms Street, Room 450
Golden, Colorado 80401

DEPARTMENT OF ECOLOGY
OLYMPIA
'88 FEB 19 A8:37

February 17, 1988

Ms. Barbara Ritchie
NEPA Coordinator
Department of Ecology
Mail Stop: PV-11
Olympia, WA 98504

REF: Puget Sound Dredged Disposal Analysis Proposed Unconfined, Open-Water Disposal Sites for Dredged Material, Phase I.

Dear Ms. Ritchie:

On February 8, 1988, we received notification from the Washington State Office of Archaeology and Historic Preservation (OAHP) of their concern that planning for the project cited above may not be proceeding in accordance with Section 106 of the National Historic Preservation Act and its implementing Regulation 36 CFR 800. Please investigate the steps taken by COE to comply with these regulations for this project, particularly 36 CFR 800.4-6, and report your findings to this office and OAHP. If consultation under the regulations has not begun, we urge that consultation begin quickly to assure proper consideration of historic properties. 1

Please contact Alan Stanfill of this office at (303) 236-2682 or FTS 776-2682 if you have questions regarding these matters or if we can be of assistance.

Sincerely,

Robert Fink
Chief, Western Division
of Project Review

RESPONSE TO ACHP

Response. See exhibit D for correspondence with the Washington State Office of Archaeology and Historic Preservation (OAHP) concerning coordination of investigations of submerged properties (shipwrecks that are potentially eligible for the National Register of Historic Places) and that could be impacted at the preferred dredged material disposal sites. As stated in the Corps letter dated April 29, 1988 the Corps, as the lead PSDDA agency in addressing submerged properties, has determined that one ship in the Elliott Bay preferred site, the A. J. Fuller, is probably eligible. This ship, and the other four features detected by sonar at this site, require further investigation, and photo documentation (if feasible). The Corps will prepare determinations of eligibility and effect for the Fuller. The PSDDA agencies have agreed to a plan of action to be formalized in a Memorandum of Agreement (MOA) between the Corps and the OAHP and ACHP. The MOA will spell out the actions required for the PSDDA management plan to achieve full compliance with Section 106 of the National Historic Preservation Act and its implementing Regulation 36 CFR 800.4-6. By letter of May 9, 1988, the OAHP has concurred with the plan of action. Conversations with ACHP staff have indicated their concurrence with the approach and willingness to enter into the MOA.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

March 2, 1988

REPLY TO ATTN OF: WD-138

Colonel Philip L. Hall
District Engineer
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124-2255

Dear Colonel Hall:

We have completed our review of the draft Environmental Impact Statement (EIS), Proposed Management Plan (PMP), and three technical appendices for the Puget Sound Dredged Disposal Analysis (PSDDA) Phase I (Central Puget Sound) Unconfined Open-Water Disposal of Dredged Material. This review was conducted in accordance with the National Environmental Policy Act (NEPA) and our responsibilities under Section 309 of the Clean Air Act.

As you are aware, we are a cooperating agency for the PSDDA effort and have been extensively involved in its development and coordination. The PSDDA study has focused on identifying and evaluating acceptable sites for the unconfined, aquatic disposal of dredged material, defining appropriate site management conditions, and developing dredged material tests and interpretation guidelines for assessing the suitability of dredged material for such disposal. A full range of alternatives has been analyzed. These documents present the four-agency consensus program, and when final, will be used by us for Advanced Identification of dredged material disposal sites in the Phase I, Central Puget Sound area, under Subpart I of the Section 404(b)(1) Guidelines of the Clean Water Act, as described at 40 CFR 230.80.

The PSDDA study involved complex, highly technical as well as social and economic considerations. This complexity is necessarily, although rather unfortunately, reflected in the extraordinary length and density of the five separate reports. Although we are pleased that the documents provide a comprehensive and thorough presentation of the rapidly evolving state-of-the-art regarding dredged material management, they may not be easily understood by the lay person whose concern is whether this proposed program will provide adequate regulatory protection to Puget Sound. Any efforts to improve the readability of the documents would be beneficial. However, we believe that the program proposed, which includes sediment evaluation, site designation, and follow-on site management actions with periodic program review, will not result in significant degradation of the aquatic environment. As noted in the documents, we recognize the rapidly changing state of dredged material testing and test interpretation. We believe that

1
2

the provision made in the management plan for annual assessment by the PSDDA agencies, with opportunities for participation by other interested agencies, organizations, and private citizens, is a particularly compelling positive feature of the program.

We commend the participating agencies' commitment and efforts to reach this consensus management program for the Phase I area. 3

We have rated the DEIS as LO - Lack of Objections, Category I - Adequate. An explanation of the EPA rating system for EISs is enclosed for your reference. This rating will be published in the Federal Register. 4

Thank you for the opportunity to review the draft EIS and supporting documents.

Sincerely,

Robie G. Russell
Regional Administrator

Enclosures

cc: Ecology
DNR
USFWS-Olympia
NMFS
COE-ERS
WDW
WDF

RESPONSE TO EPA

Response 1. Comment noted. Portions of the Management Plan Report (MPR), FEIS and the Evaluation Procedures Technical Appendix (EPTA) have been edited to improve clarity and understanding by lay readers.

Response 2. Comment noted. See MPR chapters 5.5.11, 8.5, and 9.2.6 for clarifications regarding the annual reviews that reflect the intent of the PSDDA agencies to allow all interested parties to participate in this process. We expect that an approach similar to that employed in the PSDDA study will be used.

Response 3. Comment noted.

Response 4. Comment noted.

R 3/24/88

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE SUITE 350
PORTLAND OREGON 97232-2279
(503) 230 5400

MAR 24 1988 F/NWR5

Mr. Frank Urabeck, Director
Puget Sound Dredged Disposal Analysis Study
U.S. Army Corps of Engineers
Seattle District
P.O. Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Urabeck:

We have reviewed the Draft Environmental Impact Statement (DEIS), the Puget Sound Dredged Disposal Analysis (PSDDA) Proposed Management Plan for Open-Water Disposal of Dredged Material, Phase I, and supporting documents. The five volumes were generally well-written, logically organized, and dealt in a comprehensive fashion with the environmental complexities associated with dredged material disposal. Our comments and recommendations are based on the National Marine Fisheries Service's responsibility for the protection and enhancement of marine, estuarine, and anadromous fishery resources and their supporting habitats. The following comments are organized into three sections: I. General Comments; II. Comments on Disposal Sites; and III. Comments on Testing and Monitoring.

I. General Comments

Our first objective in considering the issue of unconfined, open-water dredged material disposal in Puget Sound is avoiding adverse impacts to the aquatic environment. In our view, upland disposal remains the preferred disposal alternative for clean as well as contaminated sediments. We believe this view is echoed in the mandate of the Puget Sound Water Quality Authority (PSWQA), which states that "all governmental actions will lead toward eliminating the presence of sediments in the Puget Sound Basin that cause observable adverse effects to biological resources." This position is further underscored by the recently passed Water Quality Act of 1987 amended by the Water Pollution Control Act. This legislation designates Puget Sound as an estuary of national significance, acknowledges the existing threats from pollution, development, and overuse to the Sound's integrity, and encourages the creation of management plans that protect, preserve and restore this valuable aquatic resource. Federal, State, municipal, tribal and private organizations have also been hard at work to preserve and enhance the integrity of Puget Sound. Clearly, these efforts and others establish the

need to afford the protection of aquatic ecosystems in Puget Sound priority consideration during the evaluation of proposed activities that pose adverse impacts to these valuable public trust resources.

RESPONSE TO NMFS MARCH 24, 1988 LETTER

General Response.

Many of the concerns expressed in this letter contrast with the NMFS letter dated February 13, 1987 (see exhibit D), which expressed acceptance of the key elements of the PSDDA Phase I Management Plan. The concerns expressed in the March 24, 1988 letter were discussed with Messrs. Rollie Schmitten, Thomas E. Kruse, and Einar Wold on April 14, 1988. A draft of PSDDA agency responses to the March 24, 1988 letter was provided to Mr. Kruse by letter dated April 29, 1988 from the Study Director (see exhibit D). The NMFS response of May 9 (see exhibit D), 1988 indicates that all three of the preferred PSDDA disposal sites are now acceptable to NMFS, subject to proper disposal site management including adequate environmental monitoring. Also NMFS, a priori, no longer opposes the preferred alternative for disposal site management (site condition II (SC-II)) but will assess the acceptability of dredged material for disposal at the PSDDA sites on a project by project basis. The following detailed responses reflect this coordination as well as further consideration of the concerns raised.

Response 1. We agree that the primary management goals for activities affecting Puget Sound are the protection, preservation, and enhancement of the Sound's resources. The PSDDA management plan fully complies with all Federal and state laws and regulations and is consistent with the 1987 Puget Sound Water Quality Management Plan adopted by the Puget Sound Water Quality Authority (PSWQA). The PSWQA has accepted the Phase I plan with relatively minor concerns which have been addressed in the final documents (see the PSWQA letter). Unconfined, open-water disposal with Site Condition II (SC-II) has been accepted by the PSWQA because: (a) the preferred sites were selected to minimize impacts, (b) the sites will be monitored, and (c) the effects of sediments just passing the PSDDA disposal guidelines (SC-II) will be mitigated by the cleaner material that will also be placed at these sites.

Upland disposal of dredged material will be considered as an alternative on a project by project basis in accordance with the Clean Water Act (CWA) Section 404(b)(1) Guidelines. The PSDDA management plan in no way alters this requirement nor precludes agency or public review of each project proposal involving possible use of Puget Sound for dredged material disposal. However, upland disposal is not necessarily the most environmentally protective alternative when considering human health or impacts on the natural environment (FEIS, sections 2.02(c) and 4.02a(1)(b)). Some sediment chemicals are bio-logically active and mobile in an upland environment but would not be in a marine environment (Evaluation Procedures Technical Appendix (EPTA) II.9.3.5). Development of new upland sites would involve large areas that are presently serving residential or industrial uses or are undeveloped open spaces that serve as habitat for wildlife.

Based on the above considerations, we believe:

1. The intent of PSDDA should be to provide regulatory agencies and resource managers with an open-water dredged material disposal opportunity if less environmentally damaging disposal alternatives are not available. (2)

2. Site Condition I criteria should be adopted for all Phase I disposal locations until the relationship between sediment contamination and biological response is adequately understood and reliable monitoring techniques that evaluate chronic effects are developed. (3)

3. Each proposed disposal location should be evaluated, managed, and monitored in a manner that is appropriate and responsive to its physical and biological characteristics, and its standing as a fisheries harvest location for Indian tribes in the Puget Sound Basin. (4)

Although we acknowledge the need for a dredged material management program for unconfined open-water disposal in Puget Sound, any such program must be subject to and consistent with regulations promulgated pursuant to Section 404 of the Clean Water Act. In this regard, following implementation of the selected PSDDA program, specific projects must be carefully evaluated to ensure that the least environmentally damaging practicable dredged material disposal technique is chosen to avoid unnecessary impacts to public trust resources. Since less environmentally damaging alternatives that include upland disposal opportunities may be available, unconfined open-water disposal at designated PSDDA sites may not be the preferred alternative for a given project. (5)

"Acceptable" adverse impacts to the estuarine ecosystem resulting from the disposal of contaminated sediments permittable under site management condition II are poorly defined and virtually impossible to effectively monitor. We believe site condition I should be adopted for all disposal areas at this time. The preservation, restoration and enhancement of Puget Sound's aquatic ecosystems have been afforded priority consideration by residents throughout the Puget Sound Basin, Federal and State agencies, Indian tribes, local municipalities, and private organizations. This mandate requires a cautious approach to inwater disposal activities and necessitates the selection of site management condition I as the preferred dredged material disposal technique at this time. (6)

Response 2. Under existing CWA Section 404(b)(1) Guidelines, a determination must be made that there is no practicable alternative before open-water disposal can be allowed. Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Practicability takes into account environmental as well as economic factors. The determination of compliance with the guidelines will be made on a project by project basis as a regulatory action which is subject to full public and agency review. Accordingly, unconfined, open-water disposal of dredged material may not be the allowed alternative for all projects where this disposal option has been proposed.

Response 3. The PSDDA agencies have concluded that Site Condition I (SC-I) is unnecessarily restrictive. SC-II is fully consistent with all Federal and state laws, as well as the PSWQA management plan, and avoids unacceptable adverse impacts. Potential environmental effects of the alternative site management conditions are defined in FEIS section 2.04 by the qualitative descriptions of possible biological effects at the site and by the related quantitative disposal guidelines in EPTA II-8. Impacts to Puget Sound, under SC-II, would be minor and "acceptable" in the context of the CWA.

Sampling and biological and chemical testing requirements have been significantly increased, and more sensitive bioassays will be used, than in the past, to ensure that SC-II is not exceeded. As explained in EPTA II-7.2.1 through II-7.7, the chemical and biological testing requirements are based on Apparent Effects Threshold (AET) sediment chemistry values. Use of these values (AETs) does not require an understanding of the cause and effect relationships between sediment chemicals and biological responses in order to provide adequate protection for the marine environment. The empirical data base, which was used to generate the AET values, includes biological test responses by very sensitive test organisms. This data base has been expanded to include the results from more recent field studies.

The preferred site management condition (SC-II) does allow sublethal effects at the disposal site. However, whether these effects will actually occur is doubtful. Much of the material will have much lower chemical levels than that allowed under SC-II guidelines. Frequent physical disturbance from disposal operations will drastically alter the benthic community structure, depress species diversity and temporarily depress species abundance. Benthic species eventually recolonizing the site may be more valuable and available to demersal predators, although their abundances are expected to be low during disposal periods. Recruitment of benthic colonizers during other periods may result in localized enhancement of the benthic community to predators, although the sites are located on areas not known to have high concentrations of demersal finfish and shellfish.

Proven techniques will be employed in the monitoring of the sites. Other than for the Navy Port Gardner RADCAD site, the monitoring of the PSDDA sites will be the most extensive conducted anywhere and is designed to verify that site conditions are being met. The tests being performed on the dredged material before dumping will also be performed on the disposal sites under the monitoring plan.

Response 4. Each of the preferred disposal sites was evaluated on the basis of its physical and biological characteristics (see the Disposal Site Selection Appendix (DSSTA)). The environmental monitoring plan for each site also is site specific (see MPTA, exhibit I). Indian treaty fisheries at each site have been fully considered and actions are planned to avoid possible navigation conflicts between Indian fishing activities and disposal operations (see response No. 10).

Response 5. We agree. See response Nos. 1 and 2 above.

Response 6. We disagree. See response No. 3 above.

According to the DEIS, the preferred disposal sites are considered to possess relatively similar physical, hydrological and biological characteristics. However, we believe each site should be evaluated, managed and monitored individually in an appropriate manner that is responsive to the specific characteristics of the designated disposal site and adjacent habitats. For example, the adoption of site management condition I in Elliott Bay would exclude less than 8 percent of the material projected for open-water disposal under site management condition II during the next 15 years. Costs associated with site condition I testing, dredging, and disposal requirements would increase by only 2.5 percent. The broad application of universal regulations and management techniques throughout the Puget Sound Estuary is clearly inconsistent with the evolution of site specific resource management and should not be implemented.

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II. Comments on Disposal Sites

1. Commencement Bay: Disposal of dredged material containing contaminants consistent with site condition II will measurably increase sediment chemical levels within disposal site I boundaries, as stated in the DEIS. The sediments at this site are relatively clean at the present time. Therefore, planned disposal can be expected to have direct or cumulative effects on the biota present at the site, *possibly reducing population levels and community diversity.* Sublethal impacts to benthos are possible from chronic exposure to dredged material under site condition II. Since the degree of food web transfer of contaminants via predation or decomposition is relatively unknown, the need for site condition I as opposed to site condition II becomes apparent. We, therefore, recommend selection of site I under site condition I for Commencement Bay.

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Response 7. See response No. 4. Each of the three Phase I sites is located in low current areas that have been classified as nondispersive environments. This permits environmental monitoring of the sites. In addition to currents, there are many other characteristics that the sites have in common, e.g., low natural resource values, minimal conflict potential with most human use activities, etc.

A regional approach to dredged material management was agreed upon at the beginning of PSDDA in response to expressions from various environmental organizations, the Puget Sound ports, and other Federal and state agencies. Agencies and individuals, actively participating in PSDDA, recognize that a regional approach promotes predictable and consistent decisions which benefit environmental resources, the dredging community, and society at large. Having the same site management condition at comparable sites is consistent with the regional approach which also seeks to maintain equity among the urban embayments. From a regional standpoint, the cost increment between SC-I and SC-II is nearly $64 million over the 15-year forecast period. This is significant.

If the NMFS recommendation were adopted, Elliott Bay dredgers which have sediments that fail SC-I guidelines but pass SC-II would be penalized by the unnecessary requirement for upland disposal or the extra 20 miles or more (one-way) haul to Commencement Bay or Port Gardner disposal sites. Resource *impacts would not be significantly* lessened by SC-I.

Response 8. With SC-II there may be an increase in chemical levels within some portions of the Commencement Bay site. However, these levels will not produce unacceptable adverse effects (see response Nos. 3 and 4 above). Other portions of the preferred site which overlay the existing site are likely to experience reduced chemical levels as sediments from past disposal may have higher chemical levels than would be accepted under PSDDA guidelines. Physical impacts will include short-term reductions in benthic populations and community diversity. This is accepted as a *tradeoff* of disposal activity. However, no significant impacts are expected to important fishery resources (crab, shrimp, bottomfish) as few if any of these resources have been found within disposal site boundaries (see FEIS, sections 4.13b(3)(c) and 4.13b(4)(b)). While resource impacts would not change significantly by going to SC-I, the economic impacts would be substantial with the cost of disposal estimated to increase by $25 million over the next 15 years.

2. Elliott Bay: Sediments at this location are somewhat more contaminated. The potential for a commercial shrimp fishery is presently precluded by existing contamination. The disposal of sediments under site condition II could facilitate the persistence or even the further degradation of this situation. This proposal appears to be inconsistent with the expressed objectives of government agencies and the public to clean up Puget Sound. Adverse effects on biological resources due to sediment contamination is not expected under site condition I. Implementation of this management alternative would certainly contribute to the restoration of this biological community and a potentially valuable fishery. 9

Although each of the potential Elliott Bay disposal sites lie within the usual and accustomed fishing grounds of the Suquamish and Muckleshoot Indian Tribes, harvest activities 10

10 appear to be more concentrated in the vicinity of disposal site I than in any other portion of Elliott Bay. Potential conflicts between disposal operations and harvest activities pose serious consequences to the viability of this site as one of the remaining tribal harvest areas in Elliott Bay.

Since populations of shrimp and bottom fishes are larger at site I than site II, and potential conflicts between proposed disposal operations and existing tribal harvest activities in the vicinity of site I pose serious concerns, we recommend selection of site II under site condition I for Elliott Bay. 11

Response 9. Dredged material allowable under SC-II disposal guidelines would generally be cleaner than sediments now at the preferred disposal site. The existing sediment quality in much of the preferred site is generally poor as documented by studies undertaken by the Puget Sound Estuary Program (PSEP) (Elliott Bay Action Plan Study). High levels of Hg, Pb, Cu, PCB's, and organics including PAH's have been found within the north Harbor Island area of inner Elliott Bay. Other indicators of serious contamination are: localized areas exhibiting greater than 80 percent depressions in benthic abundance, high incidence of neoplasms in English sole, and high amphipod bioassay mortalities. Implementation of SC-I would contribute little more than SC-II to the restoration of the biological community of the preferred site, but would increase disposal costs by $4 million over the next 15 years. Accordingly with SC-II, overall site conditions should improve relative to sediment chemistry. SC-II is consistent with cleanup goals (see response No. 1 above).

Major physical impacts of disposal activities would be largely confined to that portion of the site lying below the 1,800-foot-diameter disposal zone. This is downslope from shrimp and bottomfish resources and the higher biomass and diversity which occurs in the shallower stations at the south end of the disposal site. Commercially important flatfish species (Dover sole, English sole) are more abundant at the alternative site than the preferred site.

Although a limited commercial shrimp fishery does exist in Elliott Bay, catches have been very low in recent years and this may be a consequence of sediment quality degradation in Elliott Bay. There are other possible reasons that the Elliott Bay fishery is poorly exploited. The shrimp and bottomfish resources in inner Elliott Bay are located near or in ship anchorage areas where there is considerable marine traffic. A recent side scan survey of the preferred site disclosed shipwrecks and other obstructions to nets which would also make commercial trawling difficult. Donnelly, et al. (1986), assessed the two Elliott Bay alternative sites and concluded that disposal of dredged material at the alternative nonpreferred site near Fourmile Rock would have more impact on commercial flatfish than at the preferred inner bay site.

Response 10. We recognize the important Indian fishing activities in the vicinity of the preferred Elliott Bay site. Disposal activity will be managed here and at other disposal sites to avoid potential conflicts with tribal fisheries. The FEIS discusses these potential conflicts in sections 2.05d and 4.08c(4), and notes that avoidance of conflicts will be addressed on a project by project basis at the time permit actions occur. Also, as the Department of Natural Resources (DNR) manages the disposal sites, they will coordinate with affected Indian tribes to adjust project disposal plans to avoid Indian fishing conflicts. DNR's adjustments may include complete disposal site closure or limiting disposal to those daylight hours during which tribal fishing would normally not occur. In addition, Corps CWA Section 404(b)(1) permits, which are given on a project by project basis, may specify that the dredger must comply with conditions specified in DNR site use permits. Comments on proposed dredging activities are invited from agencies, tribes, and concerned public in each Corps 404(b)(1) public notice published for dredging and disposal operations. For Corps Federal navigation projects, the Corps will coordinate with the tribes and will consider similar restrictions. Finally, the U.S. Coast Guard Navigation Rule 18 states that power driven vessels underway must avoid fishing vessels.

Response 11. Your comment is noted. We believe that site I is the best alternative for the reasons given in the EIS and in consideration of all the public comments received to date. Also, see response Nos. 9 and 10 above.

3. Port Gardner: *Existing sediments at site I do not contain elevated levels of chemicals of concern.* Disposal of dredged material under site condition II would increase sediment chemical levels within the boundaries of site I. Sublethal impacts to onsite benthos are possible from chronic exposure to chemicals present in disposed sediments. Cumulative effects could reduce population levels and community biomass, with food web impacts occurring offsite. (12)

High concentrations of Dungeness crabs occur less than a mile from the disposal site. The DEIS concludes that since the dredged sediments would contain approximately the same or less food value as the existing sediments at the site, no significant increase in the number of crabs can be expected at the site following disposal. This conclusion appears to be unfounded. (13)

Cumulative impacts to aquatic organisms and the confusion to disposal site monitoring posed by the implementation of management condition II and the proposed disposal of approximately 1 million cubic yards of contaminated sediments in Port Gardner Bay by the US Navy are matters of concern that have not been addressed in these documents. We again stress the importance for adoption of site condition I, which would preclude adverse impacts to valuable fishery resources including mobile populations of Dungeness crabs. We recommend selection of site I under site condition I. (14)

III. Comments on Testing and Monitoring

The overall plan clearly represents a major improvement over the previous methods used to judge the suitability of dredged material for unconfined open-water disposal (e.g., the Fourmile Rock guidelines). Moreover, we view the inclusion of a mechanism for annual review and modification of the recommended sediment testing methods and disposal site management to represent a particularly important feature of the overall plan. During our review we identified a few aspects of the testing and monitoring programs which should be carefully scrutinized when the selected program is placed in effect and data begin to become available. (15)

Response 12. We disagree with your conclusion for reasons given in response 3. SC-II would allow a higher level of chemicals than presently are thought to exist at the preferred Port Gardner site. However, as previously stated, the SC-II disposal guideline precludes unacceptable adverse impacts. Baseline monitoring, which was accomplished in May 1988, gathered background sediment quality data for the preferred site. The FEIS concludes that impacts to benthic resources, mobile crab and shrimp resources, and demersal fish resources will not be significant as few of these resources are found within the preferred site. See FEIS sections 4.13b(3) and 4.13b(4). SC-I would not significantly change environmental impacts, but would result in an increase of $35 million in disposal costs over the next 15 years.

Response 13. Comment noted. The FEIS section 4.13b(3) text is revised to state that no significant increase in crabs is anticipated based on depth of water instead of the relative food values of bottom sediments.

Response 14. We do not concur with your recommendation for SC-I (see response Nos. 3 and 7). Cumulative impacts of SC-II material at Port Gardner were evaluated and are discussed in the EIS section 4.13d. We believe that monitoring by both PSDDA and the Navy will distinguish effects attributable to each activity. The prevailing bottom currents in Port Gardner flow in a northwesterly direction as stated in DSSTA. Therefore, it is unlikely that dredged material disposed at the PSDDA site will be transported to the southeast onto the Navy's RADCAD disposal site. Ten chemical monitoring stations have been specified in the PSDDA baseline monitoring plan to check for the unanticipated movement of material between the Navy disposal site and the PSDDA site. These will be chemical stations established on the perimeter of the PSDDA site and at background "benchmark" stations to help assess potential movement of chemicals through the water column. The Navy has also addressed this concern by locating chemical and biological monitoring stations towards the PSDDA site. The Navy monitoring will address the potential movement of material from the Navy site to the PSDDA site employing sediment traps and other devices. The same personnel of the Corps, EPA, Ecology, and DNR are reviewing both the PSDDA and Navy monitoring activities. This should further assist coordination activities.

Response 15. Comment noted. NMFS is encouraged to participate in the annual reviews of the PSDDA management plan. We agree that all aspects of dredged material testing and disposal site monitoring should be carefully scrutinized in order that timely adjustments and improvements are made in the public interest.

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As you are well aware, the "Apparent Effects Threshold" (AET) approach for defining critical concentrations of the PSDDA chemicals of concern has certain scientific limitations. For example, adverse effects thresholds were defined solely on the basis of three acute effects bioassays, two of which are of uncertain value in assessing toxicity of sediment-associated contaminants as they deal with water-soluble compounds (oyster larvae and bacterial bioluminescence bioassays of saline elutriates), and on changes in benthic community structure, a parameter which is difficult to strictly relate to chemical contamination. Lacking from the attempt to define critical AET was a consideration of chronic lethal and sublethal effects. In this latter regard, we recognize that the lack of any scientifically developed and generally accepted chronic effects sediment bioassays was a major constraint. In any event, since the concentrations identified as screening levels should be protective of environmental quality, our principal concern is that the SL values be viewed as a "first cut". As part of the annual review process, these concentrations should be critically evaluated and adjusted when new data and/or new test methods indicate such a change is appropriate. 16

There is recent evidence that relatively high concentrations of selected butyltin species (e.g., dibutyltin, tributyltin) are detectable in sediments and biota of urban waterways of Puget Sound. We understand that tributyltin and related compounds are currently being evaluated for inclusion in the PSDDA list of chemicals of concern. We would, however, like to suggest the need for priority consideration. Their inclusion would be particularly important when dealing with sediments from harbors and other boat moorage areas. 17

The scientific rationale for the testing of saline extracts of sediments with either the oyster larval or bacterial bioluminescence bioassays is unclear given the PSDDA focus on sediment-associated contaminants. In contrast to what is stated in these reports, there is no direct evidence to suggest that a saline extract in any way approximates the bioavailable fraction of sediment-sorbed contaminants. Indeed, to the contrary, chemical analyses show that a variety of water-insoluble sediment-sorbed contaminants that are not detectable in saline extracts are bioavailable to benthic organisms. Both the oyster larval and bacterial bioluminescence bioassays can be useful tests of toxicity when used in an appropriate fashion. Both bioassays have proven potential as indicators of water column toxicity. Moreover, we have described in the peer-reviewed scientific literature the use of the bacterial bioluminescence assay for comparing and ranking sediments based on toxicity of organic extracts. However, such an approach clearly does 18

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not address the issue of bioavailability (just as the saline extract approach does not) nor were any claims ever put forth that this was the case. Nevertheless, a bioassay of an organic extract does provide a direct measure/indication of the toxicity of sediment-sorbed chemicals. Accordingly, the PSDDA program should consider testing organic extracts of sediment with the bacterial bioluminescence assay in parallel to the testing of saline extracts. 18

Response 16. We agree that, while existing screening level (SL) chemical concentrations are protective of the environment, they should be considered a "first cut." The best available tools for assessing dredged material will be used. Updates to the PSDDA evaluation procedures, and perhaps use of other tests, are possible as more and better information becomes available. For example, we acknowledge that there is a need for better biological testing to fully assess chronic and sublethal effects of sediment chemicals of concern. Presently, in cooperation with NOAA/NMFS, we are conducting additional studies that we hope will lead to such a test for regulatory decisionmaking.

Response 17. We believe we are giving butyltins the priority you suggest. Butyltins have been detected in sediments of some Puget Sound marinas in recent months. To date, none of the areas with elevated butyltins have correlated with known problem areas in the AET database. The potential effects of these chemical sediments needs to be assessed in Puget Sound, and standard analytical methods within the capabilities of local laboratory should be developed. Further evaluation of butyltins is occurring during the PSDDA Phase II studies as indicated in section II-7.1.2 of EPTA with support from NOAA/NMFS. Future revisions to the PSDDA chemicals of concern list may include butyltins and other chemicals.

The text in sections II-7.1.2 and 3 of EPTA have been revised and the potential decisionmaking consequences of data gaps for chemicals are now discussed. Recent review of AET's by an EPA contractor (PTI, Inc.) indicates very high sensitivity and efficiency for the AET method. This suggests that, should tributyltins turn out to be significant sediment toxicants in the Sound at large, they are covarying with other toxicants or else are highly localized. Thus, we concluded that the AET's are currently protective of the environment despite some lack of data.

Response 18. We have reconsidered the oyster larvae and bacterial (microtox) procedures you reference. Both are considered to be indirect or "remote" indicators of sediment toxicity. Suitable benthic test alternatives have not been identified at this time, although better tests may soon be forthcoming via PSDDA and EPA bioassay comparisons and chronic effects investigations. Cost considerations favor microtox over other methods. On the other hand, our relatively limited experience with microtox suggests that it should not be relied upon as the sole decisionmaking tool at this time. Therefore, it is only used for corroboration of other tests. We agree that no conclusions should be drawn from microtox regarding bioavailability of the chemicals of concern in the sediment phase. Saline sediment extracts expose the test organisms only to the water soluble chemicals that are readily available for organism uptake. Use of an organic extract is theoretically an appealing tool for assessing relatively water insoluble sediment chemicals. However, there is a management concern that this protocol has led to results which are extremely difficult to interpret quantitatively. Qualitative rankings are possible using this method, but the utility for decisionmaking of the organic extract method is presently limited. We hope that the ongoing EPA bioassay comparison study will provide further insight to chronic responses of organisms to sediments and will result in improved guidelines for interpretation of both saline and organic extract methods.

The disposal site monitoring plan could be made stronger by including additional predisposal samplings. Meaningful biological baselines typically incorporate data collected over several seasons and many years. 19

The routine analysis of sediments for the more water-soluble PSDDA chemicals of concern (e.g., phenols) is of limited value unless dealing with sediments from near known point-sources of these compounds. Such water-soluble contaminants would rapidly partition into seawater and would not become sediment-sorbed. 20

Phthalates are a particularly difficult group of compounds to obtain accurate data on sediment concentrations due to the myriad opportunities for extraneous phthalate contamination during sediment collection and analysis. Any data on phthalate concentrations used in a regulatory framework should be accepted only if accompanied by rigorous QA/QC data. 21

The preceeding comments and technical review are provided by the Environmental and Technical Services Division in concert with the Northwest and Alaska Fisheries Center. If you have any questions regarding the contents of this letter, please contact Rob Jones of my staff at (503) 230-5429.

Sincerely,

Einar Wold
Division Chief

cc: F/NWC6 - U. Varanasi
Suquamish Tribe - D. Kirkpatrick
Muckleshoot Tribe - M. Bradley
USFWS, ES, Olympia
EPA, Seattle
DOE
WDW
WDF
PSWQA

<u>Response 19</u>. We acknowledge your concern for having more predisposal data for later use in monitoring evaluations. However, we believe that the sampling now planned will result in adequate data within reasonable cost constraints. The monitoring plan includes predisposal background benchmark stations as a means to detect variation within the disposal site embayment from sources other than dredged material. The sampling and analysis designs will be reviewed and revised as appropriate as monitoring data are gathered. Sampling will be conducted at the same time of year for the 15-year monitoring period now planned. This will avoid data comparison problems due to seasonal variations/cycles.

<u>Response 20</u>. We agree that phenols should not be routinely analyzed after they are known not to be present in a given dredging area or bay. This is also the case for all PSDDA chemicals of concern (see section 5.5.1 of the MPR). However, we are aware that point sources other than pipe discharges can put phenols into the aquatic environment. We believe that initial checking in an area is warranted in the absence of specific information on the presence of these chemicals.

<u>Response 21</u>. We fully agree with the need for rigorous quality assurance/quality control (QA/QC) when the analysis of phthalates is required. The recommended Puget Sound protocols will be required for the regulatory analysis of material to be dredged. Also, the concern for laboratory contamination was pivotal in the decision to establish relatively high SL's for these chemicals. At these higher concentrations, low-level laboratory contamination is less of a concern.

R 3/30/88

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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March 29, 1988

Mr. Frank Urabeck, Director
Puget Sound Dredged Disposal Analysis Study
Seattle District, Corps of Engineers
P. O. Box C-3755
Seattle, Washington 98124

Re: Draft Environmental Impact Statement, Management Plan, and Technical Appendices -- Proposed Unconfined Open-Water Disposal Sites For Dredged Material, Phase 1 (Central Puget Sound)

Dear Mr. Urabeck:

We have reviewed the subject Puget Sound Dredged Disposal Analysis (PSDDA) documents prepared pursuant to the National and State Environmental Policy Acts. We offer the following comments for your use and consideration.

GENERAL COMMENTS

The draft documents synthesize an elaborate and significant three-year interagency study to improve the evaluation and management process governing unconfined, open-water disposal of dredged material. Study baseline investigations have contributed to an increased understanding of the demersal fishery resources and candidate disposal sites in Central Puget Sound.

The Fish and Wildlife Service (Service) endorses the study goal and objectives. However, several key issues need to be reevaluated and fully addressed in the final document, to better protect public trust resources of concern and to garner widespread acceptability of the proposed Phase 1 plan.

The key concerns of the Service are: (1) selection of the preferred Elliott Bay and Port Gardner disposal sites, and adverse potential impacts that may occur at these and the Commencement Bay sites; and (2) study issues related to the proposed Site Management Condition for all Phase I sites.

SPECIFIC COMMENTS

Central Puget Sound Disposal Sites

1. Elliott Bay - The Service cannot endorse selection of the proposed inner Elliott Bay site. Fewer potential impacts to shrimp and bottomfish resources would occur at the alternate (i.e., Site 2) outer Bay site. (1) Chemicals of concern in dredged material would also be subjected to increased mixing and shearing forces from the Duwamish River plume at the inner site. Contaminant suspension in the water column would be most prevalent during the winter, which coincides with the primary February-March dredging period. (2) Selection of either site poses the potential to disrupt fishing activities of the Muckleshoot and Suquamish tribes. Site 2 appears to be the environmentally less damaging disposal site option, if indeed tribal fishing is less concentrated there, and mutually satisfactory mitigation measures can be achieved with the affected tribes. (3)

2. Port Gardner - Dredged material disposal at either Site 1 or Site 2 poses greater overall potential impacts than would occur at Site 3 in Saratoga Passage. This is due to increased concentrations of important fishery (i.e., Dungeness crab, shrimp, and bottomfish) resources, and tribal drift net fishing in proximity to Port Gardner. Site 1 is also in close proximity to the U.S. Navy's preferred confined aquatic disposal (CAD) site. Site 2 overlaps the preferred CAD site. The integrity of the dredged material cap at the Navy's CAD site could be adversely affected by further disposal of PSDDA-sanctioned material. Furthermore, the interpretation of both Navy and PSDDA monitoring programs would be confounded by disposal at either Site 1 or 2. Accordingly, we recommend selection of Site 3 in Saratoga Passage. (4)

3. Other Disposal Site Assessment Issues - PSDDA-sanctioned dredged material disposal activities will not occur in a regulatory or developmental vacuum. The Service recognizes the difficulty in forecasting future dredged material volumes and the limitations in realistically assessing alternate disposal scenarios. However, the draft environmental impact statement (EIS) presents an incomplete assessment of several significant issues that pose potential, cumulatively damaging impacts.

We request the impact analyses in the EIS be modified to acknowledge and better address the following three issues.

C-14

RESPONSES TO FWS COMMENTS

Response 1. Comment noted. See response No. 9 to NMFS letter.

Response 2. Currents are actually less at the preferred site than the alternative site, located near Fourmile Rock. Consequently, there would be less potential for resuspension of dredged material placed at the preferred site (see DEIS and FEIS sections 2.03j).

Response 3. Tribal fishing conflicts will be avoided through disposal site use restrictions. See response No. 10 to NMFS letter.

Response 4. As acknowledged in the DEIS and FEIS the potential for natural resource impacts are lower at alternative site 3 (Saratoga Passage) than at sites 1 or 2. However, the proximity of site 3 to proposed aquaculture activities must also be considered and the extra haul distance from site 1 to site 3 would increase disposal costs significantly, from \$0.25 to \$0.50 per cubic yard (c.y.), limiting the practicality of this site. The Tulalip Fish Advisory Commission letter of April 26, 1988 (see exhibit D) indicates that the tribes may now be willing to accept site 1 provided that treaty fishing conflicts are avoided and proper site management occurs.

Crab trawling investigations in Port Gardner during 1986 and 1987 indicate that crab densities at and in the vicinity of site 1 are low and well below the Washington Department of Fisheries (WDF) commercial harvest threshold density of 100 crab/ha. Additionally, the preferred site is 0.75 nautical miles from crab concentration areas to the northeast, east, and southeast, which should provide an ample buffer between the site and crab resources. Bottom tidal currents are very weak at site 1 and exhibit a net movement to the northwest away from the crab concentration areas. Accordingly, crab concentration areas to the south and southeast should not be impacted by dredged material from the PSDDA site. Also as noted in the DEIS and FEIS sections 4.13b(3) and 4.13b(4) few shrimp and bottom fish resources have been found within site 1. Therefore little impacts on these resources are expected.

Water depths of over 400 feet at the preferred site will provide a sufficient buffer between the disposal site and salmon returning to Port Gardner during the "milling" period prior to their upstream migrations. Because adult salmon do not feed on the bottom at the depths of this disposal site, there is no reason to believe that the site will attract these fish. The fishery closure period (March 15 to June 15) will reduce direct conflicts between juvenile salmonids and dredging and disposal activities.

Site management conditions/restrictions will be imposed during seasonal tribal fishing activities to avoid conflicts with tribal fishermen (see response No. 10 to NMFS letter and FEIS, section 2.05d(2)).

Disposal at site 1 will not impact the Navy's CAD site as tight controls will be placed on dredgers using the PSDDA site to ensure that all dredged material

is discharged within the 1,800-foot-diameter disposal zone. Ongoing monitoring coordination will enable impacts from site 1 use to be distinguished from impacts associated with the CAD site. See response No. 14 to NMFS letter.

First, adoption and use of Elliott Bay Site 1, in conjunction with construction of the Elliott Bay Marina, poses a significant and unacceptable impact to Treaty Indian fisheries, for which meaningful mitigation is not proposed. (5)

Second, the commitment of up to 700 acres of demersal habitat in Port Gardner *for dredged material* disposal, in proximity to a major Dungeness crab concentration area, is a significant and potentially avoidable action. Finally, potential contaminant impacts at PSDDA-sanctioned sites due to the disposal of dredged material from either Federal or State Superfund listed sites, such as *Commencement* Bay, are not addressed. The draft fails to discuss this concern, and describe the relationship between the proposed PSDDA plan and statutory provisions of both Federal and State Superfund programs. (6)

Proposed Site Management Condition

We do not endorse adoption of the proposed Site II condition, which would allow "minor adverse effects" to biological resources within the disposal site. This management condition would permit chronic toxicity, and impaired reproductive and sublethal biological resource effects to occur at, and in close proximity to, the disposal sites. (7)

We recommend adoption of site management condition *I for the* initial five-year disposal site permit and monitoring analysis period. This *Site Management Condition would* provide greater environmental protectiveness and result in "no adverse acute or chronic effects." (8) The rationale for this recommendation follows:

1. The presently proposed biological and chemical guidelines reflect a less conservative approach to assessing a severe indicator (i.e., mortality) of biological effects than expected, or is presently practicable and appropriate. This shortcoming is further compounded by the lack of viable sublethal/chronic effects tests. (9)

2. The uncertain relationship between concentrations of chemicals and biological effects suggests that selection of Maximum Chemical Level 1 (ML1) is environmentally preferable to adopting ML2 values. The ML1 is equal to the lowest apparent effects threshold (AET), while ML2 is equal to the highest AET for a range of biological indicators. The more conservative ML1 criteria correspond with Site Management Condition *I*, and are generally indicative of chemical concentrations above which an unacceptable adverse effect is always expected for one biological indicator. (10)

Response 5. See response No. 3 above. Indian fisheries impacts were given special consideration during the PSDDA study (see Management Plan Report (MPR) chapter 2.8; FEIS section 2.05d(2)). Native American fisheries impacts were assessed in the *FEIS* (see section 4.08(c)(4)) for the preferred site in Elliott Bay. Site location and site management provisions of the PSDDA management plan are expected to mitigate any potential biological resource impacts and human use conflicts (see DEIS and FEIS section 5.05 and CEQ regulations at 40 CFR 1508.20).

Crab resources were carefully considered throughout the PSDDA siting process. The preferred Port Gardner site was selected over alternative site 2 to further remove the disposal site from crab concentration areas. As discussed in the FEIS, section 4.13b(3), on or offsite impacts to crabs from disposal activities are not expected to be significant. The cumulative impacts of the PSDDA preferred site and the Navy RADCAD site are discussed in the FEIS, section 4.13d. Impacts to crabs will be carefully monitored by the Navy and data evaluated by the regulatory and resource agencies throughout the project's construction, and post construction for a period of 10 years. (resource issues have been thoroughly addressed by PSDDA and the Navy such that the cumulative impacts of both PSDDA and the Navy disposal activities should not result in an unacceptable adverse impact to crab resources in Port Gardner.

Response 6. The 1985 PSDDA plan of study focused on the unconfined, open-water disposal of material dredged for the purposes of navigation maintenance and development. Material dredged solely for the purposes of contamination cleanup (e.g., Superfund program activities) was not included in the scope of PSDDA due, in part, to an assumption that sediments to be removed by cleanup programs *would not be acceptable for unconfined*, open-water disposal in Puget Sound. Also it was left to the ongoing Superfund programs to establish the appropriate remedial action plans. We do not anticipate sediments requiring removal as a Superfund action will be allowed at any of the PSDDA disposal sites. The text of the MPR (sections 2.5 and 2.6.3) has been revised to reflect the above.

Response 7. See response No. 3 to NMFS letter.

Response 8. See responses No. 3, 7, 8, and 9 to NMFS letter.

Response 9. As discussed in the section 5.4.2 of the MPR, the PSDDA biological tests are the most appropriate of available tests. Because of concerns with possible sublethal effects, the selected bioassay species represent some of the more sensitive species available for laboratory testing. Further, though the tests are "acute" (short term), they do not solely measure lethality. Abnormality in the bivalve larvae test and other sublethal effects in the microtox test are also included in the test results. The screening and

maximum concentration levels set forth for each chemical of concern also reflect consideration of the benthic apparent effects threshold, which provides some assessment of chronic community effects. While none of these indicators is adequate to independently assess the effects of concern, they combine to provide a weight of evidence that is useful in the interim in characterzing and protecting against potential sublethal effects.

PSDDA efforts to develop a chronic sediment bioassay, *initiated in Phase I*, are continuing in Phase II. The status of chronic sediment testing procedures is described in *sections II-6.4.2 and II-6.5 of the EPTA*. The Phase I efforts (work conducted by NOAA-NMFS) to develop a chronic test are described in *exhibit* E-22 of the EPTA.

Response 10. The difference in adverse effects that may occur at the sites between SC-I and SC-II is primarily a result of the biological disposal guidelines (where SC-I would allow no effects and SC-II would allow one of four test species to show some adverse effects). Screening level values are identical for SC-I and SC-II, such that environmental protection provided by the chemical guidelines does not differ between the site management alternatives. It is the uncertainty in relating chemical concentrations to adverse biological effects that suggests a higher maximum level (ML) value. A higher ML value does not signify a lesser standard of environmental protection, but rather that more material will be subjected to direct biological testing to reach a disposal decision. In other words, material that exceeds ML1 values, but is less than ML2 values, would not be "acceptable" under SC-II without meeting the biological testing requirements.

Response 11. Though the Apparent Effects Threshold (AET) values were not the sole basis for the proposed SL and ML guidelines, completed and ongoing scientific review of the AET method and values is resulting in increasing recognition of the applied strengths and management utility of the AET approach to the development of sediment quality values. During development of the SL and ML values, the AET values were tested to determine their ability to correctly predict toxicity in the Puget Sound data base. The reliability of SL and ML values were also tested on several case projects. Testing of the SL and ML values with the recently expanded Puget Sound data base has also been accomplished. In all cases, the tests have shown the SL and ML values to be reliable predictors of the presence or absence of adverse effects. The SL values have been shown to be environmentally sensitive and the ML values have been shown to be cost effective. Additionally, the methodology will be presented to the EPA Science Advisory Board in July 1988. Further discussion concerning the scientific acceptance and validity of the AET concept, and the relationship of the AET values to the proposed PSDDA SL and ML values, has been added to the text in sections II-7.2, II-7.3 and II-7.4 of EPTA.

See response No. 6 above, concerning the disposal of Superfund material at the proposed PSDDA sites.

Reservations with the scientific acceptance and validity of the AET concept also dictate our endorsement of this more conservative ML1 criteria. Potential concern for the disposal of dredged material from Commencement Bay Nearshore Tideflats Superfund "problem areas" with contaminant concentrations that exceed lowest AET values would also be alleviated. 11

3. The presently proposed test guidelines do not include oil and grease content, and several other "red flag" contaminants have been excluded as PSDDA chemicals of concern. Conspicuously absent contaminants that can be toxic in trace amounts are butyltin compounds, phlalate acid esthers (PAE's), and polychlorinated dibenzodioxin (PCDD) and its congeners. Some of these "red flag" contaminants and other lipophilic PSDDA chemicals of concern may be dispersed via the oil/grease fraction in dredged material. Potential impacts could be further minimized by adoption of ML1 criteria, and by integrating a rigorous oil/grease test standard in the guidelines. 12

4. Although sediment chemical monitoring data from all three candidate disposal sites may be available by mid-1989, biological monitoring results will not be achieved for at least four years (i.e., late 1991). This extended time period, coupled with the nonspecific "consideration" of contingency actions by PSDDA agencies to rectify possible site problems, is of concern and should be reevaluated. 13

5. Four disposal sites within known dispersive zones of feasibility are being evaluated for PSDDA Phase II (North and South Puget Sound). We foresee that adoption of dispersive PSDDA disposal sites will likely dictate selection of Site Management Condition 1 to preclude degradation of the aquatic environment pursuant to the Section 404(b)(1) guidelines. The problematic issue of differing Site Management Conditions for Phase I and Phase II sites has been identified, but not satisfactorily addressed to date by PSDDA study agencies. 14

SUMMARY COMMENTS

The Corps and other participating PSDDA agencies are to be commended for this ongoing effort to establish a strengthened interagency management plan governing the unconfined, open-water disposal of dredged material. We do not concur with the analysis of impacts governing the selection of the presently preferred disposal sites in Elliott Bay and Port Gardner. The draft EIS also inadequately addresses cumulatively damaging impacts to

Response 12. PSDDA agencies chose to refine the historic practice of measuring oil and grease concentrations in dredged material by substituting direct measurement of those chemical compounds of concern found in petroleum and combustion products. Consequently, the PSDDA list of chemicals of concern includes 16 polynuclear aromatic hydrocarbons (PAH's). Measurement of oil and grease does not identify the presence or quantify the concentration of these priority pollutant chemicals. Oil and grease measurement will not distinguish between products of petroleum origin and oils from other natural sources. In addition, the fraction of oil and grease that is available to be released to the water column and the sea surface cannot be predicted from a total oil and grease analysis. Oil and grease found in bottom sediments is considered to be substantively in a form that is not readily available for dispersal. It is often associated with particles that will settle and it has been processed to some degree during settling. Mechanically dredged material, released in a single dumping action from a bottom release barge, will also minimize the disturbance of the material and the release of oil fractions. For these reasons, the measurement of oil and grease in material to be dredged is considered to be a relatively general indicator that does not directly contribute to an assessment of the potential effects of dredged material disposal. Though the analysis of PAH's is considerably more expensive, the information can be related to possible adverse biological effects of material disposal. Discussion of dredged material disposal effects on the sea surface microlayer is provided in section II-2.3.3 of EPTA.

Six phthalates are currently included in the PSDDA chemicals of concern list, and their measurement (or suitable existing information) would be required in material to be dredged. Though tributyltin (TBT) will be analyzed during site monitoring baseline studies, organotins and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) are not currently included on the PSDDA list. Discussion of butyltins and chlorinated dioxins is contained in section II-7.1.2 of EPTA. As indicated, further research is needed with both of these chemical groups. The potential distribution and effects of these chemicals in Puget Sound sediments needs consideration, and analytical methods and local laboratory capabilities need developing before they can be added to the regulatory list for dredging projects.

See also response No. 17 to NMFS letter.

Response 13. Chemical analysis and bioassays will be performed on sediments taken from the disposal site the first year following initial disposal site use. These will provide early warnings if anticipated site conditions are not being met. Offsite biological measures are intended to augment the onsite bioassay and perimeter line chemistry checks. Biological sampling and analysis (other than bioassays) will be accomplished when sufficient volume has been placed at the site that a check for offsite effects is reasonable. A minimum of 45,000 c.y. should be placed at the site prior to initiating offsite biological sampling. In any case, offsite biological checks will be accomplished by the third year of disposal site use. The PSDDA Monitoring plan specifies steps in the analysis of monitoring data and in dealing with unanticipated problems. See MPTA, exhibit I.

Treaty Indian fishing in Elliott Bay, and substantial habitat impacts that will adversely affect important fishery resources in Port Gardner. Potential contaminant impacts attributable to the disposal of dredged material from aquatic Superfund sites merits discussion. A conservative Site Management Condition I is recommended as the least environmentally damaging dredged material management plan option for candidate Central Puget Sound sites.

We appreciate the opportunity to review and comment on the draft documents. Please contact John Cooper of this office at telephone 206-753-9440 if you have questions regarding these comments.

Sincerely,

Lynn P. Childers

Lynn P. Childers
Acting Field Supervisor

c: RO/FWE
RO/EC
BIA, Everett
EPA, Seattle
Muckleshoot Indian Tribe
PSWQA, Seattle
Puyallup Indian Tribe
Suquamish Indian Tribe
Tulalip Indian Tribe
WDE, Olympia
WDF, Olympia
WDNR, Olympia
WDW, Olympia

<u>Response 14</u>. Disposal guidelines for the Phase II disposal sites will also be based on the Section 404(b)(1) guidelines. We expect for Phase II nondispersive sites, the disposal guidelines will be the same as for Phase I. For the Phase II dispersive sites, located in high current environments where environmental monitoring is difficult and cost-prohibitive, we are tentatively proposing more restrictive disposal guidelines. Most elements of the guidelines are the same as those that will be used for the nondispersive sites. We see no problem in having slightly different guidelines when conditions warrant this.

RJ 3/1/88

THE TULALIP TRIBES

6700 TOTEM BEACH ROAD
MARYSVILLE, WA 98270
653-4585

The Tulalip Tribes are the successors in interest to the Snohomish, Snoqualmie and Skykomish tribes and other tribes and bands signatory to the Treaty of Point Elliott.

February 29, 1988

Mr. Frank Urabeck
Seattle District, Corps of Engineers
Post Office Box c-3755
Seattle, Washington 98124

Dear Mr. Urabeck,

The Tulalip Tribes would like to submit these comments regarding the Draft Environmental Impact Statement and Proposed Management Plan For Unconfined Open Water Disposal Sites For Dredged Material In Central Puget Sound.

We believe that the Puget Sound Dredged Disposal Analysis (PSDDA) process is a good one and we support continued multi-agency cooperative management and planning. While our ability to participate in this process has been restricted due to the limited size of our staff and the multitude of important natural resource issues in which we are involved, we hope our comments will receive equal weight to information already generated through the PSSDA process.

The Port Gardner and Elliot Bay alternatives lie within the Tulalip Tribes Usual and Accustomed fishing areas. However, we will confine our comments regarding disposal area siting to the Port Gardener sites. The Port Gardner area is the most immediate to the Tulalip Reservation and is a primary fishing ground for the Tribes. In recent years, the Tribe has been expanding it's fisheries activities and intends on developing bottomfish and shellfish commercial fisheries in the area.

The Tribe is opposed to the Port Gardener preferred alternative. This opposition is based on several concerns:

1. The preferred alternative lies within an area which is actively fished by tribal fisherman. Fish returning to the Stillaguamish and Snohomish systems are taken here. 1

2. Alternative site III would avoid conflicts with the fishery with no increased impacts to aquatic resources. 2

RESPONSE TO TULALIP TRIBES 29 FEBRUARY 1988 LETTER

The concerns expressed in this letter were discussed with Stan Jones, Sr., Chairman, Board of Directors, and others of The Tulalip Tribes, during a meeting held on April 15, 1988; and with the Tulalip Fish Advisory Commission on April 20, 1988. By letter dated April 26, 1988 (see exhibit D) the Fish Advisory Commission indicated that it had no objections to the Port Gardner preferred PSDDA disposal site provided that dredged material placed there has been extensively evaluated, proper site monitoring is performed and conflicts with tribal fishing are avoided.

Response 1. Tribal fishing in area of preferred site is acknowledged (see DEIS and FEIS sections 3.04b(3), 3.04c(4), and 4.13c(4)).

Response 2. We recognize the important Indian fishing activities in the vicinity of the preferred Port Gardner site. Disposal activity will be managed here and at other disposal sites to avoid potential conflicts with tribal fisheries. The FEIS discusses these potential conflicts in sections 2.05d, and 4.13c(4), and notes that avoidance of conflicts will be addressed on a project by project basis at the time permit actions occur. Also, as the Department of Natural Resources (DNR) manages the disposal sites, they will coordinate with affected Indian tribes to adjust project disposal plans to avoid Indian fishing conflicts. DNR's adjustments may include complete disposal site closure or limiting disposal to those daylight hours during which tribal fishing would normally not occur. In addition, Corps CWA Section 404(b)(1) permits, which are given on a project by project basis, may specify that the dredger must comply with conditions specified in DNR site use permits. Comments on proposed dredging activities are invited from agencies, tribes, and concerned public in each Corps 404(b)(1) public notice published for dredging and disposal operations. For Corps Federal navigation projects, the Corps will coordinate with the tribes and will consider similar restrictions. Finally, the U.S. Coast Guard Navigation Rule 18 states that power driven vessels underway must avoid fishing vessels.

As noted in the DEIS and FEIS the potential for natural resource impacts are lower at alternate site 3 (Saratoga Passage) than at sites 1 or 2. However, the proximity of site 3 to proposed aquaculture activities must be considered and the extra haul distance from site 1 to site 3 would increase disposal costs significantly, from \$0.25 to \$0.50 per cubic yard (c.y.), limiting the practicality of this site. The Tulalip Fish Advisory Commission acknowledged the higher costs associated with site 3 in their April 26, 1988 letter (see exhibit D). We also reviewed with the Tulalip Tribe the reasons why an alternative site (informally suggested by Mr. Terry Williams) located west of Gedney Island would not be appropriate. These reasons include (a) bottom current velocities in excess of nondispersive site criteria, (b) proximity to fish resources, (c) proximity to bald eagle nests, (d) steep bottom slopes, and (e) administrative complications in having two local shoreline jurisdictions involved in permits for the site.

3. The preferred Port Gardener site is located adjacent to the permitted Confined Aquatic Disposal site (CAD) which will be used by the U.S. navy and their contractors for disposal of contaminated dredge material. This CAD project is highly experimental in nature and will involve substantial monitoring efforts. These monitoring efforts will be severely complicated and compromised by the siting of an open water unconfined disposal site at the proposed preferred location. Alternative site III would avoid these impacts also. (3)

We disagree with the conclusion found on page 4-108 (DEIS) which finds that there is not likely to be a significant impact on Treaty fishing activities. As already mentioned, this area is used by tribal fisherman deploying drift gillnets. We believe that direct conflict between fishing gear and barge traffic will occur and could be avoided by choosing site III. (4)

We would also like to state that we support management for resource site condition I. Given the significant public support for, and agency resources committed to, clean up of the Puget Sound, we believe it is essential that the management plan for unconfined dredged material be consistent with this goal. Furthermore, we believe that our understanding of the long term effects allowed under resource condition II are poorly understood and not adequately addressed by the PSSDA process or the DEIS. It is clear that site condition II will allow the degradation of existing resource conditions and will also allow long term sub-lethal effects. We believe this is not appropriate and will impact the tribes ability to develop bottomfish and shellfish resources in the area. (5)

We also believe that an extensive monitoring and enforcement program should be included in the preferred alternative. Specifically, performance criteria should be developed and strictly enforced. Monitoring of disposal operations should be conducted to assure careful placement of dredged material, and long term chemical and biological testing should be conducted to assess resource health. (6)

We thank you for the opportunity to comment.

Sincerely,
The Tulalip Tribes

Dave Somers for
Terry Williams, Fisheries Director

TSC
John Rollins
Banks
Parker
ERS
Williams
Keith Phillips
Dist. Gossy

<u>Response 3.</u> We believe that monitoring by both PSDDA and Navy will distinguish effects attributable to each activity. The prevailing bottom currents in Port Gardner flow in a northwesterly direction as stated in the Disposal Site Selection Technical Appendix (DSSTA). Therefore, it is unlikely that dredged material disposed at the PSDDA site will be transported to the southeast onto the Navy's RADCAD disposal site. Ten chemical monitoring stations have been specified in the PSDDA baseline monitoring plan to check for the unanticipated movement of material between the Navy disposal site and the PSDDA site. These will be chemical stations established on the perimeter of the PSDDA site and at background "benchmark" stations to help assess potential movement of chemicals through the water column. The Navy has also addressed this concern by locating chemical and biological monitoring stations towards the PSDDA site. The Navy monitoring also addresses the potential movement of material from the Navy site to the PSDDA site by employing sediment traps and other measurement/detection devices. The same personnel of the Corps, EPA, Ecology, and DNR are reviewing both the PSDDA and Navy monitoring activities. This should further assist coordination activities.

<u>Response 4.</u> See response No. 2 above and Fish Advisory Commission letter of April 26, 1988.

<u>Response 5.</u> The PSDDA agencies have concluded that Site Condition I (SC-1) is unnecessarily restrictive. SC-II is fully consistent with all Federal and State laws, as well as the Puget Sound Water Quality Authority Water Quality Management Plan, and avoids unacceptable adverse impacts. Potential environmental effects of the alternative site management conditions are defined in EIS section 2.04 by the qualitative descriptions of possible biological effects at the site and by the related quantitative disposal guidelines in the Evaluation Procedures Technical Appendix (EPTA) II-8. Impacts to Puget Sound, under SC-II, would be minor and "acceptable" in the context of the Clean Water Act (CWA).

Sampling and biological and chemical testing requirements have been significantly increased, and more sensitive bioassays will be used to ensure that SC-II is not exceeded. As explained in EPTA II-7.2.1 through II-7.2.7, the chemical and biological testing requirements are based on Apparent Effects Threshold (AET) sediment chemistry values. Use of these values (AETs) does not require an understanding of the cause and effect relationships between sediment chemicals and biological responses in order to provide adequate protection for the marine environment. The empirical data base, which was used to generate the AET values, includes biological test responses by very sensitive test organisms. This data base has been expanded to include the results from more recent field studies.

The preferred site management condition (SC-II) does allow sublethal effects at the disposal site. However, whether these effects will actually occur is doubtful. Much of the material will have much lower chemical levels than that allowed under SC-II guidelines. Physical disturbance from disposal operations will drastically alter the benthic community structure, depress species diversity and temporarily depress species abundance. Benthic species eventually recolonizing the site may be more valuable and available to demersal predators although their abundances are expected to be low during disposal periods. Recruitment of benthic colonizers during other periods may result in localized

enhancement of the benthic community to predators, although the site is in an area of low concentrations of demersal finfish and shellfish.

Proven techniques will be employed in the monitoring of the sites. Other than for the Navy Port Gardner RADCAD site, the monitoring of the PSDDA sites will be the most extensive conducted anywhere and is designed to verify that site conditions are being met. The tests being performed on the dredged material before dumping will also be performed on the disposal sites under the monitoring plan.

Response 6. We agree. Compliance inspections of disposal at the PSDDA sites will be mady by DNR on a spot check basis, using mobile shore based radar. During the first year of site use relatively high frequency checking will be undertaken to ensure dredged material is being discharged within the 1,800-foot-diameter disposal zone. An extensive monitoring program, which includes performance criteria, is planned for all the Phase I sites including Port Gardner (see the Management Plan Technical Appendix, Exhibit I). Also see response 3 above for special treatment given the Port Gardner site due to the proximity of the Navy RADCAD disposal site. The Tulalip Tribes will be kept informed of the monitoring results and given an opportunity to review the monitoring data.

Rd 2/16/88

Area Code (206)
598-3311

THE SUQUAMISH TRIBE

P.O. Box 498   Suquamish, Washington 98392

March 7, 1988

Mr. Frank Urabeck
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Wa. 98124

RE: PSDDA EIS and Management Plan

Dear Mr. Urabeck:

The Suquamish Tribe has reviewed the draft Environmental Impact Statement and draft Proposed Management Plan for Unconfined Open-water Disposal of Dredged Material, Phase 1. Our comments on these drafts follow.

Site Selection

The Suquamish Tribe is very concerned about the preferred disposal site proposed for the Elliott Bay area. As you know, both the Elliott Bay disposal sites lie within the usual and accustomed fishing grounds of the Suquamish Tribe. You are also aware that (as the EIS acknowledges, p.4-82), tribal fishing is more concentrated around the preferred site than site 2. In fact, fishing around the mouth of the Duwamish River, near the preferred disposal site, is more densely concentrated than any other fishing area within Elliott Bay. Yet, the EIS maintains that ZSF's were not located in areas of high fishing use and that "primarily because of the site selection process followed by PSDDA, there is little potential for unacceptable adverse effects to occur to Puget Sound tribal fishing rights". The Suquamish Tribe strongly disagrees with both of these statements. If ZSF's were indeed not located in areas of high fishing use, neither of the proposed disposal sites in Elliott Bay would have been chosen. 1

In addition, while the EIS states that "...coordination between tribal fisheries and disposal operations is expected to avoid conflicts as outlined in section 2...", we see no specific details discussed in section 2 of the EIS that provide the necessary assurance and certainty that conflicts will be avoided. Will disposal operations be completely curtailed during fishing season (July through February)? How will disposal barge traffic be coordinated with tribal fishing vessels? How soon after individual disposal operations do the PSDDA agencies believe there will be no impact to tribal fishing activities? What do the PSDDA agencies believe the effects of concurrent dredging (near the mouth of the Duwamish) and disposal operations (near the mouth of the Duwamish) will be on tribal fishing activities? 2

RESPONSES TO SUQUAMISH TRIBE 7 MARCH 1988 LETTER

Response 1. Comment noted. The FEIS has been clarified (see FEIS Section 2.03e(1)). The zones of siting feasibility (ZSF) were developed through a mapping process based on a literature review of best available information concerning resources and human use activities which should be avoided to the extent practicable in establishing a disposal site. Available information suggested that Indian tribal fishing occurred throughout Elliott Bay. While all potential conflicts were considered it was recognized that it would be impossible to select an area where all conflicts could be avoided. Therefore, potential human use conflicts which could be handled through disposal management were not as controlling in the ZSF and final site selection process as were fish resources and other factors such as bottom currents. The DEIS and FEIS acknowledge that the preferred site has a higher potential for navigation conflicts with tribal fishing than the alternative site, however, they also note that the conflicts will be avoided (see DEIS and FESI sections 2.05d).

Response 2. We recognize the important Indian fishing activities in the vicinity of the preferred Elliott Bay site. Disposal activity will be managed here and at other disposal sites to avoid potential conflicts with tribal fisheries. The EIS discusses these potential conflicts in sections 2.05d and 4.08c(4), and notes that avoidance of conflicts will be addressed on a project by project basis at the time permit actions occur. Also, as the Department of Natural Resources (DNR) manages the disposal sites, they will coordinate with affected Indian tribes to adjust project disposal plans to avoid Indian fishing conflicts. DNR's adjustments may include complete disposal site closure or limiting disposal to those daylight hours during which tribal fishing would normally not occur. In addition, Corps CWA Section 404(b)(1) permits, which are given on a project by project basis, may specify that the dredger must comply with conditions specified in DNR site use permits. Comments on proposed dredging activities are invited from agencies, tribes, and concerned public in each Corps 404(b)(1) public notice published for dredging and disposal operations. For Corps Federal navigation projects, the Corps will coordinate with the tribes and will consider similar restrictions. Finally, the U.S. Coast Guard Navigation Rule 18 states that power driven vessels underway must avoid fishing vessels.

We have expanded our discussion of how the PSDDA plan deals with Indian treaty fishing rights and how these rights will be protected (see Management Plan Report (MPR) chapter 2.8 and DEIS and FEIS sections 2.05). The text in section 2.05 has been clarified as shown by the underlined changes shown below:

"Permitting authorities will allow disposal to occur when there is no treaty fishing activity occuring at the disposal site. This will be accomplished via the DNR disposal site use permit and the Section 404 permit process. During processing of individual Section 404 applications, any conflict between treaty fishing and vessel traffic will be addressed prior to disposal. Conditioning

2

Alternative disposal sites should be actively considered in the permit process.

Monitoring

3

Monitoring is a very important component of the PSDDA program. Without monitoring we have no way of gaining an understanding of the wide-ranging effects of dredge disposal operations and adapting management of these sites to prevent adverse impacts. Without accurate and adequate monitoring efforts the goals of the PSDDA process would not be attained.

4

The Management Plans Technical Appendix (p I-39) implies that monitoring of bottom dwelling organisms at the Elliott Bay preferred site will not provide useful information because the Bay is already seriously contaminated by other sources and therefore biological changes over time cannot necessarily be attributable to dredge spoil disposal. These are valid concerns, however, if detailed baseline information is collected, couldn't this problem be alleviated? We still feel it is absolutely necessary to monitor biological resources *to show that no adverse effects* of dredge disposal are occurring off-site. This information would also be useful to analyze in comparison to other PSDDA sites. Biological stations must be included for Elliott Bay.

5

As stated in the Site Selection comments above, if the PSDDA agencies firmly believe that useful biological information cannot be collected at the preferred site, then in our view, this point adds to the arguement that site 1 in Elliott Bay should not be selected.

Evaluation

6

The Suquamish Tribe opposes allowing sediments with chemistry exceeding maximum levels to be disposed at open water sites. If sediment chemistry is exceeded it seems unlikely that material could pass additional bioaccumulation and water column effects tests. However, even if the material could pass additional tests, the results from the sediment chemistry tests should never be overlooked. Dredge material that exceeds maximum chemistry levels should not be disposed at unconfined open water sites.

of permits such that disposal will be consistent with tribal fishing operations may be appropriate as may be denial of permit applications where necessary.

In following this permitting process, disposal-related vessel traffic and fishing gear conflicts with tribal fishing operations should not occur. Violations of permit conditions, including permit conditions based on protecting treaty rights, are enforceable under Federal law."

Little dredging is expected to occur near the mouth of the Duwamish River as water depths in the East and West Waterways are much greater than presently required for navigation. We expect little change in normal dredging activity which has produced no reported conflicts with Indian fishing activities. The dredging volume forecasts include an allowance for the proposed Duwamish widening and deepening navigation project, which would involve dredging the lower river. This project is now in a deferred status due to lack of a local project sponsor.

Response 3. We agree monitoring is important and have therefore included environmental monitoring as a key element of the PSDDA Management Plan.

Response 4. Biological stations have been added to the baseline monitoring plan for Elliott Bay. Data will be analyzed after each monitoring effort. Changes to the evaluation procedures may be made based on those data. The Suquamish Tribe will be kept informed of the monitoring results and given an opportunity to review the monitoring data.

Response 5. See response No. 4.

Response 6. Comment noted. It is extremely unlikely that sediments containing chemicals in concentrations in excess of the maximum levels would ever pass the battery of biological tests that include not only those presently specified by PSDDA but also unspecified tests which would be set forth by the regulatory agencies. For this reason very few dredgers would exercise the option for doing these tests. However, as a matter of principle, we feel the dredger should have the option of demonstrating through special biological tests that project sediments would not cause unacceptable adverse effects. As with all projects, where disposal in waters of the United States are involved, a public notice of permit action for such a project would be provided.

Response 7. Major physical impacts of disposal activities would be largely confined to that portion of the site lying below the 1,800-foot-diamter disposal zone. This is downslope from shrimp and bottomfish resources and the higher biomass and diversity which occurs in the shallower stations at the south end of the disposal site. Commercially important flatfish species (Dover sole, English sole) are more abundant at the alternative site than the preferred site.

Although a limited commercial spotted shrimp fishery does exist in Elliott Bay, catches have been very low in recent years and this may be a consequence

These are some of the questions we feel should be addressed in Section 2 of the EIS.

Besides our concerns about effects on tribal fishing acitivities, there are other reasons to question the choice of the preferred site in Elliott Bay. Impacts to shrimp and bottom fish would be greater at the preferred site than at site 2 (p. 4-81, 82). And there appears to be some problem with monitoring efforts at the preferred site. If monitoring of biological resources at the preferred site will not delineate effects of the dredge spoils on bioaccumulation and benthic abundance, then perhaps this site should not be chosen (see further discussion of monitoring below). For these reasons then, the Suquamish Tribe is opposed to the selection of the Elliott Bay preferred site. 7

Disposal Site Condition

The Suquamish Tribe is firmly opposed to the disposal of site condition II material in open water unconfined sites. The PSDDA process should not be advocating use of Puget Sound as a dumping ground for contaminated material. The mandate of all resources agencies involved in the clean-up of Puget Sound is to protect, maintain and/or improve environmental quality. We feel the management plan for dredge disposal should be consistent with this mandate. 8

In addition, current understanding of the long-term effects produced by site condition II material is incomplete and inadequate. Disposal of this material at several disposal sites throughout Puget Sound would represent large scale experimentation. If site condition II material is disposed in Elliott Bay, Tribes and tribal resources could be forced to bear significant losses due to degradation of existing resource conditions and long term sublethal effects. 9

Almost half of the Phase I area dredge spoils will be disposed in Elliott Bay. By allowing only disposal of site condition I material here, less than 10% of the material anticipated to be disposed of at the Elliott Bay open water site will go to upland or near shore sites over the next 15 years. This seems a small price to pay to protect Tribal fishing operations and tribal resources. We feel strongly that only site condition I material should be allowed in open water unconfined sites. 10

We would also like to see the consideration of other disposal sites for site condition I material. All site condition I material should not automatically go to open water disposal if better use can be made of the material at other sites, i.e. the creation of intertidal habitat in the Duwamish Waterway and/or along the Elliott Bay shoreline. 11

of sediment quality degradation in Elliott Bay. There are other possible reasons that the Elliott Bay fishery is poorly exploited. The shrimp and bottomfish resources in inner Elliott Bay are located near or in ship anchorage areas where there is considerable marine traffic. A recent sidescan survey of the preferred site disclosed shipwrecks and other obstructions to nets which would also make commercial trawling difficult. Donnelly, et al. (1986), assessed the two Elliott Bay alternative sites and concluded that disposal of dredged material at the alternative nonpreferred site near Fourmile Rock would have more impact on commercial flatfish trawling than at the preferred inner bay site.

Bioassays conducted on sediments sampled from the disposal site will provide a measure of biological effects. We do not anticipate any offsite movement of sediments or chemicals. However, we have added offsite biological stations (see response No. 4 above).

Response 8. As discussed in section 4.08 of the FEIS, dredged material that passes the SC-II guidelines is expected to have lower chemical levels than much of the existing bottom sediments at the Elliott Bay preferred disposal site. Also, as a great amount of the material to be discharged at the Elliott site is of substantially better quality (lower chemical concentrations and biological effects) than that which would just pass the SC-II guidelines, the actual effect on the site is expected to be less than that described for SC-II in the DEIS and FEIS. As a result, further degradation of existing resources is not anticipated and, in fact, a betterment is expected at much of the Elliott Bay site.

The 1987 Puget Sound Water Quality Authority (PSWQA) Management Plan recognizes that dredging and dredged material disposal can contribute to the cleanup of the Sound. Contaminated materials that are dredged from harbors and waterways are removed from the marine environment and placed in confined disposal sites. Removal of contaminated sediments coincidentally contributes to the improvement of fish passage and rearing areas. The PSWQA plan also accepts the possibility of some adverse biological effects at the unconfined, open-water sites in the near term. The PSWQA has concurred with the selection of the Elliott Bay preferred disposal site and SC-II for disposal site management at all Phase I nondispersive site.

Sampling and biological and chemical testing requirements have been significantly increased, and more sensitive bioassays will be used to ensure that SC-II is not exceeded. As explained in EPTA II-7.2.1 through II-7.2.7, the chemical and biological testing requirements are based on Apparent Effects Threshold (AET) sediment chemistry values. Use of these values (AETs) does not require an understanding of the cause and effect relationships between sediment chemicals and biological responses in order to provide adquate protection for the marine environment. The empirical data base, which was used to generate the AET values, includes biological test responses by very sensitive test organisms. This data base has been expanded to include the results from more recent field studies.

We thank you for the opportunity to comment on these documents. We appreciate the efforts the PSDDA agencies and others have contributed to this valuable process.

Sincerely,

Tony Forsman

Tony Forsman
Fisheries Director
Suquamish Indian Tribe

cc: NMFS
USFWS
Muckleshoot Indian Tribe

cc TSC

Proven techniques will be employed in the monitoring of the sites. Other than for the Navy Port Gardner RADCAD site, the monitoring of the PSDDA sites will be the most extensive conducted anywhere and is designed to verify that site conditions are being met. The tests being performed on the dredged material before dumping will also be performed on the disposal sites under the monitoring plan.

Response 9. Tribal resources are not expected to experience any losses due to disposal at the preferred site or use of site condition II (see response No. 8 above). The preferred site management condition (SC-II) does allow sublethal effects at the disposal site. However, whether these effects will actually occur is doubtful. Much of the material will have much lower chemical levels than that allowed under SC-II guidelines. During disposal periods, physical disturbance of the site is expected to inhibit development of an abundant or diverse benthic infaunal community that would be exposed to the dredged material. At this time the depressed infaunal community will not be attractive to feeding demersal fish. Finally, the site is generally located in an area which does not have significant populations of demersal finfish and shellfish.

Response 10. See responses No. 8 and 9 above. Disposal guidelines based on SC-II are very restrictive. Only an estimated 32 percent of the dredged material that potentially could be considered for disposal at the preferred Elliott Bay site would be acceptable for disposal there. This compares with 58 percent of the total Phase I area. We feel that tribal fishing operations and tribal resources will be well served by the PSDDA Management Plan. Disposal guidelines based in SC-I would only preclude an additional 4 percent of the dredged material. The PSDDA agencies have concluded that Site Condition I (SC-I) is unnecessarily restrictive. SC-II is fully consistent with all Federal and State laws, as well as the PSWQA management plan, and avoids unacceptable adverse impacts. Potential environmental effects of the alternative site management conditions are defined in EIS section 2.04 by the qualitative descriptions of possible biological effects at the site and by the related quantitative disposal guidelines in EPTA II-8. Impacts to Puget Sound, under SC-II would be minor and "acceptable" in the context of the CWA.

Response 11. Under the Section 404 permit process, the Corps and EPA, with input from FWS and NMFS, evaluates the impacts of individual dredging projects under the 404(b)(1) guidelines. The dredger must also obtain a Section 401 State Water Quality Certificate from Ecology. As part of the process the dredger may propose uses for the clean material other than unconfined, open-water disposal. Mitigation for project impacts may be required and result in proposals to create intertidal habitat in project specific locations. These types of activities will be planned on a project specific basis with input from the regulatory and resource agencies and comments received in respone to the Corps public notice for each proposed project. As provided in Corps regulations, the Indian tribes may provide for a tribal representative to receive and respond to public notices with the official tribal position (33 CFR 320.4(j)(6)). See MPR chapter 2.5 for a discussion of beneficial uses of dredged material.

RJ 3/15/88

MUCKLESHOOT INDIAN TRIBE

March 14, 1988

U.S. Army Corps of Engineers
Seattle District
Regulatory Branch
Post Office Box C-3755
Seattle, WA 98124

Attn: Frank Urabeck
Study Director, PSDDA

Re: Comments on Draft Environmental Impact Statement-Proposed Unconfined Open-Water Disposal Sites for Dredged Material, Phase 1 (Central Puget Sound)

Dear Mr. Urabeck,

The Muckleshoot Indian Tribe is in receipt of the Draft Environmental Impact Statement - Proposed Unconfined Open-Water Disposal Sites for Dredged Material, Phase 1 (Central Puget Sound) along with the proposed management plan and supporting documents.

The Muckleshoot Tribe is a federally recognized Indian tribe that holds treaty fishing rights in Elliott Bay under the Treaty of Point Elliott (12 Stat. 927). United States v. Washington, 384 F.Supp. 312, 367 (W.D. Wash. 1974); aff'd. 520 F.2d 676 (9th Cir. 1975). See also Washington v. Washington State Commercial Passenger Fishing Vessel Ass'n., 443 U.S. 658 (1979). Under the treaty, the Tribe is guaranteed 50% of all anadromous fish that pass through the Tribe's usual and accustomed fishing grounds and stations. Elliott Bay has been adjudicated as a usual and accustomed fishing area of the Tribe. Id. The Tribe also has fishing rights on the White River. Id. Fish runs destined for the White River pass through Commencement Bay.

One of the rights guaranteed by the Treaty is the right of access to all usual and accustomed fishing grounds and stations. See United States v. Winans, 198 U.S. 371 (1905); United States v. Oregon, 718 F.2d 299 (9th Cir. 1983); Confederated Bands and Tribes of the Umatilla Reservation v. Alexander, 440 F.Supp. 555 (D.Or. 1977). The time, place and manner in which a tribe exercises treaty fishing rights at usual and accustomed fishing areas cannot be regulated except as necessary for the

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conservation of the fish. See Puyallup Tribe v. Washington Department of Game (Puyallup I), 391 U.S. 392 (1968). Additionally, the Tribe has a right, flowing from the treaties, to protection of the fishery habitat from adverse effects.

The Tribe generally commends the people involved in the Puget Sound Dredge Disposal Analysis (PSDDA) for the amount of time and effort that has gone into this project. This project, as the Tribe understands it, is considered to be a model for the rest of the country. Environmentally sound disposal of dredged spoils is an important issue, and the PSDDA has made much progress over existing methods and analyses. Nonetheless, the Tribe believes that there are some issues that need to be addressed.

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The Tribe's concerns break down into two general areas. First, a major concern to the Tribe and its members is that the preferred alternative for the disposal site in Elliott Bay is located directly in the Tribe's major fishing area in inner Elliott Bay. Second, the Tribe has some concerns regarding the environmental issues involved in the disposal of dredged spoils in Elliott Bay and Commencement Bay. These will be discussed in order.

The preferred dredged spoils disposal site in Elliott Bay would be in an area heavily used by Tribal members in exercising treaty fishing rights. This is acknowledged in the draft EIS:

> One of the more concentrated areas of tribal fishing activity in inner Elliott Bay is the area north of the mouth of the Duwamish Waterways, outside of the regulated 1,000-foot closure areas. The PSDDA preferred alternative disposal site for Elliott Bay begins 2,500 feet from the mouth of the waterways, and thus is within this high-use tribal fishing area (figure 3.10). The surface target dumping zone is in the southern half of the disposal site, beginning 4,000 feet from the waterways. However it, too, is still within the area of higher tribal fishing activity.

DEIS at p. 3-63. Designation and use of the preferred Elliott Bay disposal site has the potential to disrupt tribal fishing activities.

In response to this problem, project specific actions to resolve the conflict are proposed. The DEIS advances the following proposition:

> Permitting authorities will allow disposal to occur only if there is no elimination of tribal fishing operations. This will be accomplished via the Section 404 permit process. During processing of individual

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RESPONSES TO MUCKLESHOOT INDIAN TRIBE
14 MARCH 1988 LETTER

Response 1. Comments appreciated. As noted in section 2 of the Proposed Management Plan (PMP) report the PSDDA plan is unique to the Puget Sound area for a variety of reasons (see chapter 2.7 of PMP and Management Plan Report (MPR) (final version of PMP). Dredged material management, with implementation of the PSDDA plan, will help improve the overall quality of Puget Sound.

Response 2. We recognize the important Indian fishing activities in the vicinity of the preferred Elliott Bay site. We believe there will be no impact to tribal fishing activities. PSDDA agencies have given very serious consideration to tribal fishing activities and are committed to avoiding navigation conflicts between dredger disposal vessels and tribal fishing craft. Disposal activity will be managed here and at other disposal sites to avoid potential conflicts with tribal fisheries. The DEIS and FEIS discuss these potential conflicts in sections 2.05d, 4.03c(4), and 4.08c(4), and note that avoidance of conflicts will be addressed on a project by project basis in the permits required for dredging projects. Alternative disposal sites are required to be considered as part of the Section 404 permit evaluation process. Also, as the Department of Natural Resources (DNR) manages the disposal sites, it will coordinate with affected Indian tribes to adjust project disposal plans to avoid Indian fishing conflicts. DNR's adjustments may include complete disposal site closure or limiting disposal to those daylight hours during which tribal fishing would normally not occur. In addition, Corps Clean Water Act (CWA) Section 404(b)(1) permits, which are given on a project by project basis, may also contain conditions which conform to DNR requirements. Comments on proposed dredging activities are invited from agencies, tribes, and the concerned public in each Corps 404(b)(1) public notice published for dredging and disposal operations. For Corps Federal navigation projects, the Corps will coordinate with the tribes and will consider similar restrictions. Finally, the U.S. Coast Guard Navigation Rule 18 states that power driven vessels underway must avoid fishing vessels. Also see response No. 8 below.

We expect little change in normal dredging activity which has produced no reported conflicts with Indian fishing activities in the past. Not much dredging is expected to occur near the mouth of the Duwamish River as water depths in the East and West Waterways are greater than presently required for navigation. As noted in response No. 4, below, the dredging volume forecasts include an allowance for the proposed Duwamish widening and deepening navigation project, which would involve dredging the lower river. This project is now in a deferred status due to lack of a local project sponsor.

Response 3. We reviewed the FEIS on the Elliott Bay Small Craft Harbor during the PSDDA process and we believe that use of the preferred site will not contribute to a cumulative loss of tribal fishing areas. As outlined in comment 2, the Corps and DNR will manage the disposal site area so that it will continue to be available for tribal fishing.

Section 404 applications, any conflict between treaty fishing and vessel traffic will be addressed prior to disposal. Conditioning of permits such that disposal will be consistent with tribal fishing operations may be appropriate as may be denial of permit applications where necessary.

DEIS at p. 2-49. While the Tribe agrees that no disposal can occur that would interfere with tribal fishing, the Tribe is concerned that the issue is merely being deferred until a later time. Instead, the issue must be analyzed now so that a fully informed decision can be made. 2

The National Environmental Policy Act (NEPA), 42 U.S.C. §4332, requires that analysis of potential impacts occur prior to taking actions. Agencies cannot decide to "act now and deal with the environmental consequences later." Methow Valley Citizens Council v. Regional Forester, 833 F.2d 810, 819 (9th Cir. 1987); Foundation for North American Wild Sheep v. United States Dept. of Agriculture, 681 F.2d 1172, 1181 (9th Cir. 1982). 3

The continuing potential cumulative loss of fishing area in Elliott Bay is of great concern to the Tribe. There are only three areas left in Elliott Bay where productive fishing occurs- the areas offshore of Magnolia Bluff and Alki Point, and in the area of the preferred alternative disposal site in inner Elliott Bay. The Corps is already attempting to permit a large scale marina to be built and operated in the area off of Magnolia Bluff. That project would substantially interfere with the Tribe's fishing in that area. Now it is proposed that the dredge disposal site be located right in the one of the other remaining fishing areas. The EIS must thoroughly analyze these cumulative impacts.

It is well established under NEPA that EISs must discuss, analyze and evaluate the cumulative consequences of proposals. Baltimore Gas and Electric Co. v. Natural Resources Defense Council, 462 U.S. 87 (1983); Oregon Natural Resources Council v. Marsh, 832 F.2d 1489, 1497-98 (9th Cir. 1987). When conducting the required cumulative impact analysis, the agency must "consider cumulative impacts of the proposed actions which supplement or aggravate the impacts of past, present and reasonably foreseeable actions." Id.

The Tribe's other major concern is the environmental impact of the designation and use of the preferred alternative disposal sites in Elliott Bay and Commencement Bay. Both sites were designated based upon the assumption that dredging over the next fifteen years will greatly exceed the amount of dredging over the last fifteen years. Yet little or no analysis is given concerning the environmental consequences of encouraging increased dredging in these two bays. Estuarine habitat is 4

Response 4. The availability of disposal sites does not encourage dredging. Dredging is a costly activity that is done in response to a need to maintain deep and shallow draft navigation benefiting all navigation traffic. While the dredging volumes forecast for the Elliott Bay and Commencement Bay areas are greater for the future 15-year period than the past, this is primarily due to two large proposed Federal projects. One of the projects is not presently being pursued. Without the Duwamish Widening and Deepening project the forecast dredging volumes are about the same as past levels.

Future dredging and disposal volumes had no direct bearing on the disposal site selection process. Site selection factors included consideration of tidal currents (low current or nondispersive locations were sought to allow environmental monitoring of site performance), biological resources and human use activities such as navigation traffic and Indian treaty fisheries (see DEIS and FEIS section 2).

Potential disposal at the Elliott Bay site, under Site Condition II guidelines (SC-II), is projected to be 3,374,000 cubic yards (c.y.) (see DEIS and FEIS Summary, table 1b). This is 1.2 million c.y. less than the amount of material discharged at the site between 1970-1985 (see PMP and MPR table 2.2). Some of the projected disposal volume also includes dredging from the currently deferred Duwamish widening and deepening project. The 200 percent increase per cubic yard in disposal site user fees by DNR, and the substantial increase in testing costs associated with the new PSDDA evaluation procedures, will tend to ensure that dredging and disposal at unconfined, open-water disposal sites are only accomplished when there is adequate economic justification based on real need.

As noted in the DEIS and FEIS sections 4.08d and 4.12, use of the Elliott Bay preferred site under preferred SC-II should result in less overall impact to the fishery habitat, including nearshore areas. Under SC-I the same amount of dredging is anticipated and nearly the same potential volume of dredged material would be acceptable for disposal at the Elliott Bay site as under SC-II (see DEIS and FEIS, Summary, table 1b).

Response 5. A rigorous monitoring program is provided for in the PSDDA Management Plan. See the Management Plans Technical Appendix (MPTA), Exhibit I for the specifics of the monitoring program for the preferred Elliott Bay site. We have added biological stations to the baseline monitoring plan for Elliott Bay. Data will be analyzed after each monitoring effort. Changes to the dredged material evaluation procedures and disposal site management may be made based on those data. The Puget Sound tribes will be kept informed of the monitoring results and given an opportunity to review the monitoring data. The monitoring program does allow for the closure of the disposal site (see MPR chapter 7.4.3) if the ecological significance of unanticipated impacts warrants this action.

Response 6. We disagree (see response No. 3 above). The DEIS and FEIS fully evaluate cumulative impacts of disposal at all disposal sites. A comprehensive environmental monitoring program has been included as part of the plan so

already extremely limited in those two bays, yet no evaluation is given regarding the impacts of both increased dredging and the effects of the disposal sites on the remaining habitat. The fishery habitat of both bays are important and must be protected. 4

The Tribe also believes that a rigorous monitoring program must be carried out no matter where the disposal occurs. Because of the acknowledged potential sublethal effects upon the fishery, it is important that monitoring of the dredge materials and their disposal be continuously and carefully carried out. Results of the monitoring must be evaluated. If the evaluation shows potential adverse effects occurring, the plan must allow for shutdown of the site. The Tribe must be involved in the monitoring process, including the receipt of the various monitoring reports and studies. 5

The draft EIS makes little attempt to analyze and evaluate the cumulative biological impacts of unconfined disposal of dredged materials. As mentioned earlier, NEPA requires that cumulative impacts be thoroughly analyzed. Such an evaluation of the long term cumulative impacts is necessary to an informed decision. 6

Existing pollution, along with dredging and filling, in Elliott Bay and Commencement Bay has adversely affected the fishery resource upon which the Tribe depends for the meaningful exercise of its treaty fishing rights. These adverse impacts must be reversed. Not only must the use of the disposal sites not increase the level of contamination of these bays, but the existing levels must be reduced. The EIS does not provide a thorough analysis of this issue. 7

Because of the potential conflict with the exercise of the Tribe's treaty fishing rights, and the current inadequacies of the draft EIS, the Tribe believes that additional work must be conducted. If you have any questions or comments, please do not hesitate to contact the Tribe's Fisheries Department. 8

Sincerely,

Walt Pach

Walter Pacheco
Fisheries Manager

cc: Terry Williams/Tulalip
Joe Anderson/Puyallup
Tony Forsman/Suquamish

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that the magnitude and significance of any unanticipated impacts can be assessed and dealt with through disposal site management. Discussions of cumulative impacts on biological resources at/near these sites are provided in DEIS and FEIS sections 4.03 to 4.06 for Commencement Bay and sections 4.08 to 4.11 for Elliott Bay. Additionally, sections 4.03 and 4.08 describe the cumulative effects of exposure of benthic infaunal resources to dredged material at the Elliott Bay and Commencement Bay sites. The environmental monitoring program is described in DEIS/FEIS sections 2.05b and in the Management Plans. Technical Appendix (MPTA) exhibit 1.

Response 7. As discussed in section 4.08 of the FEIS, dredged material that passes the SC-II guidelines is expected to have lower chemical levels than much of the existing bottom sediments at the Elliott Bay preferred disposal site. Also, as a great amount of the material to be discharged at both the Elliott and Commencement Bay sites is of substantially better quality (lower chemical concentrations and biological effects) than that which would just pass the SC-II guidelines, the actual effect on the sites is expected to be less than that described for SC-II in the DEIS and FEIS. As a result, further degradation of existing resources in these bays is not anticipated and, in fact, a betterment is expected at portions of both bays.

The 1987 Puget Sound Water Quality Management Plan recognizes that dredging and dredged material disposal can contribute to the cleanup of the Sound. Contaminated materials that are dredged from harbors and waterways are removed from the marine environment and placed in confined disposal sites. Removal of contaminated sediments coincidentally contributes to the improvement of fish passage and rearing areas. The PSWQA plan also accepts some adverse biological effects at the unconfined, open-water sites in the near term. The PSWQA has concurred with the selection of the Elliott Bay and Commencement Bay preferred disposal sites and SC-II for disposal site management at all Phase 1 nondispersive sites.

Response 8. Comment noted. See response No. 2 above. We have expanded our discussion of how the PSDDA plan deals with Indian treaty fishing rights and how these rights will be protected (see MPR chapter 2.8 and DEIS and FEIS sections 2.05). The text in section 2.05 has been clarified as shown by the underlined changes shown below:

"Permitting authorities will allow disposal to occur when there is no treaty fishing activity occurring at the disposal site. This will be accomplished via the DNR disposal site use permit and the Section 404 permit process. During processing of individual Section 404 applications, any conflict between treaty fishing and vessel traffic will be addressed prior to disposal. Conditioning of permits such that disposal will be consistent with tribal fishing operations may be appropriate as may be denial of permit applications where necessary.

In following this permitting process, disposal-related vessel traffic and fishing gear conflicts with tribal fishing operations should not occur. Violations of permit conditions, including permit conditions based on protecting treaty rights, are enforceable under Federal law."

RL 3/17/88

Puyallup Tribe of Indians

March 15, 1988

U.S. Army *Corps of Engineers*
Seattle District
Regulatory Branch
P.O. Box C-3755
Seattle, Washington 98124

Attn: Frank Urabeck
Study Director, PSDDA

RE: Comments on Draft *Environmental Impact Statement* - Proposed Unconfined Open-Water Disposal Sites for *Dredged Material, Phase I (Central Puget Sound)*

Dear Mr. Urabeck:

The Puyallup Tribe would like to submit the following comments on the Puget Sound Dredged Disposal Analysis (PSDDA) draft environmental impact statement for the Phase I area.

The Puyallup Tribe is a federally recognized Indian tribe that holds treaty fishing rights in Commencement Bay under the Treaty of Medicine Creek (10 Stat. 1032). United States v. Washington, 384 F.Supp. 312, 370-71 (W.D. Wash. 1974); *aff'd*, 520 *F.2d* 676 (9th Cir. 1975). See also Washington v. Washington State Commercial Passenger Fishing Vessel Ass'n, 443 U.S. 658 (1979). Under the treaty, the Tribe is guaranteed 50% of all anadromous fish that pass through the Tribe's usual and accustomed fishing grounds and stations. Commencement Bay has been adjudicated as a usual and accustomed fishing area of the Tribe. Id. The Tribe also has fishing rights on the Puyallup River. Id. Fish runs destined for the Puyallup River pass through Commencement Bay.

One of the rights guaranteed by the Treaty is the right of access to all usual and accustomed fishing grounds and stations. See United States v. Winans, 198 U.S. 371 (1905); United States v. Oregon, 718 *F.2d* 299 (9th Cir. 1983); Confederated Bands and Tribes of the Umatilla Reservation v. Alexander, 440 F.Supp. 555 (D.Or. 1977). The time, place and manner in which a tribe exercises treaty fishing rights at usual and accustomed fishing areas cannot be regulated except as necessary for the conservation of the fish. See Puyallup Tribe v. Washington Dept. of Game, (Puyallup I), 391 U.S. 392 (1968). Additionally, the Tribe has a right, flowing from the treaties, to protection of the fishery habitat from adverse effects.

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The Tribe generally commends the people involved in the *Puget* Sound Dredge Disposal Analysis (PSDDA) for the amount of time and effort that has *gone into this project*. This project, as the *Tribe understands it*, *is considered to be a model* for the rest of the country. Environmentally sound disposal of dredged spoils is an important issue, and the PSDDA has made much progress over existing methods and analyses. *Nonetheless*, the Tribe believes that there *are some* issues that need to be addressed.

1

The Tribe's concerns break down into two general areas. *First*, a major concern to the Tribe and its members is that *the preferred* alternative for the disposal *site in* Commencement Bay is right in the Tribe's *major* fishing area in Commencement Bay. Second, the Tribe has some concerns regarding the environmental issues involved in the disposal of dredged spoils in Commencement Bay.

The preferred dredged spoils disposal site in Commencement Bay would be in an area heavily used by Tribal members in exercising treaty fishing rights. This is acknowledged in the draft EIS at pp. 4-19; 4-44.

The DEIS acknowledges possible impacts both on tribal access rights and on water quality (and therefore, to fisheries health). In response to this problem, project specific actions to resolve the conflict are proposed. The DEIS advances the following proposition:

> Permitting authorities will allow disposal to occur only if there is no elimination of tribal fishing operations. This will be accomplished via the Section 404 permit *process*. During processing of *individual* Section 404 applications, any *conflict* between treaty fishing and vessel traffic will be addressed prior to disposal. Conditioning of permits such that disposal will be consistent with tribal fishing operations may be appropriate as may be *denial of permit* applications *where necessary*.

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DEIS at p. 2-49. While the Tribe agrees that no disposal can occur that would interfere with tribal fishing, the Tribe is concerned that the issue is merely being *deferred* until a later *time*. *Instead, the issue must be analyzed* now *in a programatic* EIS so that a fully informed decision can be made.

RESPONSES TO PUYALLUP TRIBE OF INDIANS
14 MARCH 1988 LETTER

Response 1. Comments appreciated. As noted in section 2 of the Proposed Management Plan (PMP) report the PSDDA plan is unique to the Puget Sound area for a variety of reasons (see chapter 2.7 of PMP and Management Plan Report (MPR) (final version of PMP). Dredged material management, with implementation of the PSDDA plan, will help improve the overall quality of Puget Sound.

Response 2. We recognize the important Indian fishing activities in the vicinity of the preferred Commencement Bay site. We believe there will be no impact to tribal fishing activities. PSDDA agencies have given very serious consideration to tribal fishing activities and are committed to avoiding navigation conflicts between dredger disposal vessels and tribal fishing craft. Disposal activity will be managed here and at other disposal sites to avoid potential conflicts with tribal fisheries. The DEIS and FEIS discuss these potential conflicts in sections 2.05d, and 4.03c(4), and note that avoidance of conflicts will be addressed on a project by project basis in the permits required for dredging projects. Alternative disposal sites are required to be considered as part of the Section 404 permit evaluation process. Also, as the Department of Natural Resources (DNR) manages the disposal sites, it will coordinate with affected Indian tribes to adjust project disposal plans to avoid Indian fishing conflicts. DNR's adjustments may include complete disposal site closure or limiting disposal to those daylight hours during which tribal fishing would normally not occur. In addition, Corps Clean Water Act (CWA) Section 404(b)(1) permits, which are given on a project by project basis, may also contain conditions which conform to DNR requirements. Comments on proposed dredging activities are invited from agencies, tribes, and the concerned public in each Corps 404(b)(1) public notice published for dredging and disposal operations. For Corps Federal navigation projects, the Corps will coordinate with the tribes and will consider similar restrictions. Finally, the U.S. Coast Guard Navigation Rule 18 states that power driven vessels underway must avoid fishing vessels. Also see response No. 13 below.

Response 3. We believe that use of the preferred Commencement Bay disposal site will not contribute to a cumulative loss of tribal fishing areas. As outlined in comment 2, the Corps and DNR will manage the disposal site area so that it will continue to be available for tribal fishing. Corps action on the permit for filling of the Milwaukee Waterway is still pending. A supplemental DEIS, being prepared by the Port of Tacoma on this project, will be reviewed relative to tribal fishing and other impacts.

Response 4. The availability of disposal sites does not encourage dredging. Dredging is a costly activity that is done in response to a need to maintain deep and shallow draft navigation benefiting all navigation traffic. While the dredging volume forecast for the Commencement Bay area is greater for the future 15-year period than the past, this is primarily due to the large proposed Blair/Sitcum navigation improvement project which would be completed within a 2-year construction period, if undertaken. Without this project

The National Environmental Policy Act (NEPA), 42 U.S.C. 4332, requires that analysis of potential impacts occur prior to taking actions. Agencies cannot decide to "act now and deal with the *environmental* consequences later." Methow Valley Citizens Council v. Regional Forester, 833 F.2d 810, 819 (9th Cir. 1987); Foundation for North American Wild Sheep v. United States Dept. of Agriculture, 681 F.2d 1172, 1181 (9th Cir. 1982).

The continuing potential cumulative loss of fishing area in Commencement Bay is of great concern to the Tribe. There are only a few areas left in Commencement Bay *where productive* fishing occurs, including the area of the preferred alternative disposal site in Commencement Bay. The Corps is already *attempting to permit a fill* of Milwaukee Waterway. That project would substantially interfere with the Tribe's fishing in that area. Now it is proposed that the dredge disposal site be located right in another remaining fishing area. The EIS must thoroughly analyze *these cumulative* impacts. (3)

It is well established under NEPA that EISs must discuss, analyze and evaluate the cumulative consequences of proposals. *Baltimore* Gas & Electric Co. v. Natural Resources Defense Council, 462 U.S. 87 (1983); Oregon Natural Resources Council v. Marsh, 832 F.2d 1489, 1497-98 (9th Cir. 1987). *When conducting the required* cumulative impact analysis, the agency must "consider cumulative impacts of the proposed actions which supplement or aggravate the impacts of past, present and reasonably foreseeable actions." Id.

The Tribe's other major concern is the environmental impact of the designation and use of the preferred *alternative disposal* sites in Commencement Bay. This site was designated based upon the assumption that *dredging* over the next fifteen years will *greatly exceed the amount of dredging over the last fifteen* years. Yet little or no analysis is given concerning the environmental consequences of encouraging increased dredging in Commencement Bay. Estuarine habitat is already extremely limited, yet no evaluation is *given* regarding the impacts of both increased dredging and the effects of the disposal sites on the remaining habitat. The fishery habitat of the bay is important and must be protected. (4)

(2.5 million c.y.) the average annual dredging volume over the 15-year forecast period is only about 15,000 cubic yards per year greater than the period 1970-1985.

Future dredging and disposal volumes had no direct bearing on the disposal site selection process. Site selection *factors included consideration of* tidal currents (low current or nondispersive locations were sought to allow environmental monitoring of site performance), biological resources and human use *activities such as navigation traffic and Indian treaty fisheries* (see DEIS and FEIS section 2).

Potential disposal at the Commencement Bay site, under Site Condition II guidelines (SC-II), is projected to be 3,160,000 cubic yards (c.y.) (see DEIS and FEIS Summary, table 1b). This is 2.4 million c.y. more than the amount of material discharged at the site between 1970-1985 (see PMP and MPR tables 2.1 and 2.2). Most of the projected *disposal volume includes dredged material* from the proposed Blair/Sitcum navigation improvement project. The 200 percent increase per cubic yard in disposal site user fees by DNR, and the substantial increase in testing costs *associated with the new* PSDDA evaluation procedures, will tend to ensure that dredging and disposal at unconfined, open-water *disposal sites are only accomplished when there is adequate* economic justification based on real need.

As noted in the DEIS and FEIS section 4.07, use of the Commencement Bay preferred site under preferred SC-II should result in less overall impact to the *fishery habitat, including nearshore areas. Under SC-I the same amount of* dredging is anticipated. Without the Blair/Sitcum project about the same potential volume of dredged material would be acceptable for disposal at the Commencement Bay site *as under SC-II (see* MPR tables 2.1 and 2.2; DEIS and FEIS, Summary, table 1a).

Response 5. A rigorous monitoring program is provided for the PSDDA Management Plan. See the Management Plans Technical Appendix (MPTA), exhibit I for the specifics of the monitoring program for the preferred Commencement Bay site. Data will be analyzed after each monitoring effort. Changes to the dredged material evaluation procedures and *disposal site management may* be made based on those data. The Puget Sound tribes will be kept informed of the monitoring results and given an opportunity to review the monitoring data. The monitoring program does allow for closure of the *disposal site (see MPR* chapter 7.4.3), if the ecological significance of unanticipated impacts warrants this action.

Response 6. We agree. The PSDDA Management Plan fully complies with all Federal and State laws and regulations and is consistent with the 1987 Puget Sound Water Quality Management Plan adopted by the Puget Sound Water Quality Authority (PSWQA). The *PSWQA has accepted the Phase I plan with relatively* minor concerns which have been addressed in the final documents (see the PSWQA letter). Unconfined, open-water disposal with Site Condition II (SC-II) has been accepted by the PSWQA because: (a) the preferred sites were selected to minimize impacts, (b) the sites will be monitored, and (c) the effects of

The Tribe also believes that if a plan can be worked out that protects every aspect of our treaty-protected fishing rights, a rigorous monitoring program must be carried out no matter where the disposal occurs. Because of the acknowledged potential sublethal effects upon the fishery, it is important that monitoring of the dredge materials and their disposal be continuously and carefully carried out. Results of the monitoring must be evaluated. If the evaluation shows potential adverse effects occurring, the plan must allow for shutdown of the site. (5)

The Puyallup Tribe must also insist that unconfined open water disposal of dredged material in the deepwater area within Commencement Bay meet all requirements under existing federal law. This includes Section 404 of the Federal Water Pollution Control Act, Section 401 of the Clean Water Act, and trust responsibilities of Federal agencies in maintaining treaty protected natural resources. (6)

Continued usage of Commencement Bay as an unconfined deep water disposal site cannot be allowed without an adequate evaluation of the cumulative biological impacts. The draft EIS does not quantify what these long term impacts might be. (7)

As previously stated, the preferred alternative for Commencement Bay deep water disposal lies within the usual and accustomed fishing area of the Puyallup Tribe. This site is actively fished by tribal fishermen with 1,800 ft. drift marine gill nets. These marine fishermen will become displaced because of increased vessel traffic to and from the dredged disposal site. (8)

The Puyallup Tribe must insist that no level of increased contamination of Commencement Bay be institutionalized in a process such as PSSDA. Because of current pollution levels, the Puyallup Tribe has gone without most of their treaty-reserved shellfish fishing rights. The draft EIS must address any possible impacts which might delay the recovery of shellfish resources off of Brown's Point and adjacent areas. (9)

In addition to these general concerns, the Puyallup Tribe has the following specific comments.

sediments just passing the PSDDA disposal guidelines (SC-II) will be mitigated by the cleaner material that will also be placed at these sites.

Please see MPR chapter 1 for discussion of Federal and State laws that are applicable to the PSDDA Management Plan and FEIS Summary, table 5 for an assessment of the plan in relationship to environmental protection statutes. MPR chapter 2.8 and FEIS sections 2, 3 and 4 contain discussions related to Indian treaty natural resource concerns.

Response 7. We disagree (see response No. 3 above). The DEIS and FEIS fully evaluate cumulative impacts of disposal at all disposal sites. A comprehensive environmental monitoring program has been included as part of the plan so that the magnitude and significance of any unanticipated impacts can be assessed and dealt with through disposal site management. Discussions of cumulative impacts on biological resources at/near these sites are provided in DEIS and FEIS sections 4.03 to 4.06 for Commencement Bay. Additionally, section 4.03d describes the cumulative effects of exposure of benthic infaunal resources to dredged material at the Commencement Bay site.

Response 8. See response No. 2 above.

Response 9. With Site Management Condition II (SC-II) there may be an increase in chemicals within some portions of the Commencement Bay site. However, these levels will not produce unacceptable adverse effects (see response Nos. 3 and 4 above). Other portions of the preferred site which overlay the existing site are likely to experience reduced chemical levels as sediments from past disposal may have higher chemical levels than would be accepted under PSDDA guidelines. Physical impacts will include short-term reductions in benthic populations and community diversity. This is accepted as a tradeoff of disposal activity. However, no significant impacts are expected to important fishery resources (crab, shrimp, bottomfish) as few if any of these resources have been found within disposal site boundaries (see FEIS section 4). While resource impacts would not change significantly by going to SC-I, the economic impacts would be substantial with the cost of disposal estimated to increase by $25 million over the next 15 years.

The PSDDA agencies have concluded that Site Conditions I (SC-I) is unnecessarily restrictive. SC-II is fully consistent with all Federal and State laws, as well as the PSWQA management plan, and avoids unacceptable adverse impacts. Potential environmental effects of the alternative site management conditions are defined in EIS sectin 2.04 by the qualitative descriptions of possible biological effects at the site and by the related quantitative disposal guidelines in the Evaluation Procedures Technical Appendix (EPTA) II-8. Impacts to Puget Sound, under SC-II, would be minor and "acceptable" in the context of the CWA.

Sampling and biological and chemical testing requirements have been significantly increased, and more sensitive bioassays will be used to ensure that SC-II is not exceeded. The preferred site management condition (SC-II) does allow sublethal effects at the disposal site. However, whether these effects

The PSSDA draft EIS provides for exceptions to the proposed guidelines without any input from tribal "professional" judgment. 10

Under the PSSDA process, the Puyallup Tribe would not receive copies of the annual reports from any monitoring studies. 11

Bioassays (AET) that do not detect long term chronic effects cannot substitute for the amount of chemical analysis needed to detect adverse biological effects impacting treaty-protected fisheries aquatic resources. 12

Because of the inadequacy of the PSSDA draft EIS and the lack of a mechanism for tribal input to exceptions to PSSDA guidelines, we cannot see where the Puyallup Tribe's treaty rights are being protected and we are of the firm belief that the draft EIS is inadequate as a matter of law. 13

Sincerely,

Henry John

Henry John, Chairman
Puyallup Environmental Commission

RRH:HJ/gp

cc: BIA, Everett

will actually occur is doubtful. Much of the material will have much lower chemical levels than that allowed under SC-II guidelines. Physical disturbance from disposal operations will drastically alter the benthic community structure, depress species diversity and temporarily depress species abundance. Benthic species eventually recolonizing the site may be more valuable and available to demersal predators although their abundances are expected to be low during disposal periods. Recruitment of benthic colonizers during other periods may result in localized enhancement of the benthic community to predators, although the site is in an area of low concentrations of demersal finfish and shellfish.

Response 10. As discussed in chapter 5.5.10 and exhibit A.10 of the MPR and sections I-2.4 and I-2.5 of EPTA, the PSDDA Management Plan is intended to provide both consistency and flexibility in the application of dredged material evaluation procedures. All decisions require documentation of the reasons for the decisions including responses to comments provided to the public notice for each project. This documentation will be made available to the Puyallup Tribe and other interested parties. The concerns expressed by tribal representatives for a specific project will be addressed during the decisionmaking process. As provided in Corps regulations, the District Engineer may develop operating procedures whereby Indian tribes may provide for a tribal representative to receive and respond to public notices with the official tribal position (33 CFR 320.4(j)(6)). Text in section A.10 of the MPR has been revised to reflect this review process.

Response 11. The management plan has been revised to include the tribes as interested parties who will receive copies of the annual monitoring reports and also have an opportunity to provide comments (see MPR chapter 8).

Response 12. As discussed in section 5.4.2 of the MPR, the biological tests proposed by PSDDA agencies are the most appropriate of the tests available today. Because of our concerns with sublethal effects, the selected bioassay species represent some of the more sensitive species available for laboratory testing. Further, though the tests are "acute" (short term), they do not soley measure lethality. Abnormality in the bivalve larvae test and other sublethal effects in the microtox test are also included in the test results. The screening and maximum levels also incorporate the benthic apparent effects threshold (AET), which provides some assessment of chronic community effects. While none of these indicators is adequate to independently assess the effects of concern, they combine to provide a weight of evidence that is useful in the interim in characterizing and protecting against potential sublethal effects.

Our efforts to develop a chronic sediment bioassay, initiated in Phase I, are continuing in Phase II. The status of chronic sediment testing procedures is described in sections II-6.4.2 and II-6.5 of the EPTA. The Phase I efforts (work conducted by NOAA-NMFS) to develop a chronic test are described in exhibit E-22 of the EPTA.

Biological testing will not be used in place of chemical testing. In all cases, testing (if existing information is not sufficient) for sediment

chemicals of concern will be the required first step in characterizing the material to be dredged. Biological testing will follow as a second step, depending on results of the chemical tests (see MPR exhibit A).

<u>Response 13</u>. Comment noted. See response No. 2 above. <u>We have expanded our discussion</u> of how the PSDDA plan deals with Indian treaty fishing rights and how these rights will be protected (see MPR chapter 2.8 and DEIS and FEIS sections 2.05). The text in section 2.05 has been clarified as shown by the underlined changes shown below:

"Permitting authorities will allow disposal to occur <u>when</u> there is no <u>treaty</u> fishing <u>activity occurring at the disposal site</u>. <u>This will be accomplished</u> via <u>the DNR disposal site use permit</u> and the Section 404 permit process. During <u>processing of individual</u> Section 404 applications, any conflict between treaty fishing and vessel traffic will be addressed prior to disposal. Conditioning of permits such that disposal will be consistent with tribal fishing operations may be appropriate as may be denial of permit applications where necessary.

In following this permitting process, disposal-related vessel traffic and fishing gear conflicts with tribal fishing operations should not occur. Violations of permit conditions, including permit conditions based on protecting treaty rights, are enforceable under Federal law."

Chuck Clarke
[redacted]
Director

STATE OF WASHINGTON

DEPARTMENT OF COMMUNITY DEVELOPMENT

OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION

111 West Twenty-first Avenue KL-11 • Olympia Washington 98504-5411 • (206) 753-4011 • SCAN 234-4011

February 5, 1988

Ms. Barbara Ritchie
NEPA Coordinator
Department of Ecology
Mail Stop: PV-11
Olympia, WA 98504

Log Reference: 1008-F-COE-S-04
Re: Puget Sound Dredged Disposal
Analysis Proposed Unconfined

Dear Ms. Ritchie:

A staff review has been conducted of the draft Environmental Impact Statement titled "Puget Sound Dredged Disposal Analysis (PSDDA) Proposed Unconfined, Open-Water Disposal Sites for Dredged Material, Phase I (Central Puget Sound)" and supporting documents. We are concerned with the treatment of cultural resources and compliance with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR 800.

We are supportive of the Corps of Engineers attempts to identify if the proposed disposal sites contain National Register eligible properties but note that complete identification activities and consultation with our Office has yet to take place. We would like to request a copy of the technical cultural resources survey report that summarized the sources and process the Corps undertook to identify if submerged resources occur in the proposed disposal sites.

Given the fact that additional identification, evaluation and mitigative measures are proposed to occur in the future, as the site baseline documentation occurs, we believe it is important that the Corps enter into a Memorandum of Agreement (MOA) with our Office and the Federal Advisory Council on Historic Preservation and other concerned parties. The MOA should address the documentation requirements and process for identification, evaluation, and implementation of protective measures for any discovered submerged historic properties.

We would urge the Corps to initiate consultation on a Memorandum of Agreement with our Office and the Advisory Council on Historic Preservation as soon as possible.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(206) 753-4405

mr

cc: Robert Fink
Caroline Gallacci
Frank Hrabeck

ERS (Weinman/Rice)
Parker
Hogan

TSC
Ridlington CENPDCO

RESPONSE TO DCD-OAHP LETTER OF 5 FEBRUARY 1988

Response. As documented in the Corps April 29, 1988 letter to the Office of Archaeology and Historic Preservation (OAHP) we have addressed cultural resources that could be impacted by dredged material disposed in accordance with PSDDA Management Plan (see exhibit D). We are in the process of complying with the requirements of Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR 800. This is confirmed by OAHP letter of May 9, 1988 (also see exhibit D).

Subsequent to receipt of February 5, 1988 letter, further extensive coordination was accomplished with OAHP. Expanded literature review was undertaken of marine cultural resources, specifically shipwrecks, that may be located at the preferred disposal sites. Literature research conducted in 1985 had revealed no vessels at any of the disposal sites; Elliott Bay (Seattle), Port Gardner (Everett), and Commencement Bay (Tacoma). Also, high resolution side scan surveys were conducted in March 1988 of the disposal sites to establish if there were sunken vessels in or near the sites. In an interagency meeting on March 25, 1988, attended by Dr. Robert G. Whitman, Ph.D, of OAHP, preliminary findings and recommendations (see below) were discussed. A copy of a preliminary consultant's report was provided to Dr. Whitman during the meeting. The final report further documenting the literature review and field reconnaissance was provided to OAHP in May 1988.

The literature review included an annotated list of potentially significant historic vessels in the vicinity of all three disposal sites. The sonar records show no shipwrecks at either the Port Gardner (Everett) or Commencement Bay (Tacoma) disposal sites.

At the preferred Elliott Bay site sonar records and archival research suggest five possible vessels may be resting on the site. Two of them appear to be vessels potentially eligible for the National Register of Historic Places. The ships are tentatively identified to be the A.J. FULLER and the MULTNOMAH. Their potential for eligibility is based on their age (they were built and sunk near the end of the age of sailing vessels), their construction (wooden or cold-rolled steel), on the limited representation of their class of ships worldwide, and possibly also their embodiment of maritime history in Washington State. There were an additional three sitings that could be submerged vessels, but do not match any historic records of historical ships that appear to be eligible. Of the five sonar "targets," only one (an unidentified object about 35 feet long) is located in the direct impact area below the disposal zone. Additional work is underway, in coordination with OAHP, regarding the Elliott Bay site.

See FEIS section 4.08c(9) for further discussion. As acknowledged in the OAHP May 9 letter, with the completion of an MOA (as outlined in the April 29 Corps letter) and the Remote Operated Vehicle (ROV) reconnaissance, the Federal record of decision can be filed. This will allow the Elliott Bay disposal site to be made available for use, subject only to a shoreline permit from the city of Seattle.

KATHERINE FLETCHER
Chair

STATE OF WASHINGTON

PUGET SOUND WATER QUALITY AUTHORITY

217 Pine Street, Suite 1100 • Seattle, Washington 98101 • (206) 464-7320

February 24, 1988

Frank J. Urabeck
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Dear Mr. Frank ~~Urabeck~~:

The Puget Sound Water Quality Authority has reviewed the draft Environmental Impact Statement and draft Proposed Management Plan for Unconfined Open-water Disposal of Dredged Material, Phase 1. We commend the four PSDDA agencies, and especially the Seattle District, for the effort that has gone into this project. Our comments on the drafts are organized into major topics.

Environmental Impact Statement

The Environmental Impact Statement (EIS) appears to be complete and comprehensive. The Authority has no specific comments on the EIS.

Site Conditions

Site condition refers to the degree of harm that is expected to occur at the disposal site as a result of chemical contamination of the dredged material. As addressed by PSDDA, it is the condition that would occur at the site if most or all of the material placed at the site is so contaminated so as to barely pass the evaluation procedures (a worst case assumption). The alternatives considered are "No" adverse effects (Site Condition I), "Minor" adverse effects (Site Condition II), and "Moderate" adverse effects (Site Condition III). The recommendation for Phase I is to allow Site Condition II at all three sites.

The long term goal of the Authority is that all significant sources of contamination to the sediments be controlled and that existing sediment hot spots be cleaned up. It is therefore the Authority's long-term goal that dredged material disposal sites have "NO" chemical adverse effects. We concur with the PSDDA recommendation of Site Condition II ("Minor" adverse effects) for the near term because: the sites are being selected to minimize the resources affected; the sites will receive large of amounts of material that would pass a Site Condition I standard, which will moderate the potential effects of the material that falls between conditions I and II; and the proposed program of monitoring and reevaluation will allow protective adjustments to the evaluation procedures if problems develop.

It is the goal of the Authority that as experience is developed with the

R 2/26/88

RESPONSES TO PSWQA 24 FEBRUARY 1988 LETTER

Response 1. The views of the PSWQA are acknowledged. The text of the Management Plan Report (MPR) has been revised (see chapter 5.4.2) to read "If dredged material exceedingthe ML values is found to be acceptable for unconfined, open-water disposal based on special biological testing, then this material may be allowed to be discharged at the PSDDA disposal sites or other appropriate locations. However, PSDDA agencies will need to be satisfied that such disposal does not complicate monitoring of the PSDDA site nor produce other problems." Also see response No. 6 to the Suquamish Tribe letter.

Response 2. PSWQA acceptance of Elliott Bay and Commencement Bay preferred sites is acknowledged. In response to PSWQA concerns about the Port Gardner site the PSDDA agencies have evaluated possible movement of the site to a more acceptable location while still staying within the existing zone of siting feasibility (ZSF), as suggested by PSWQA. Our review, coordinated with Mr. John Dorhman of the PSWQA and Mr. Terry Williams, Tulalip Tribes, confirmed that the site cannot be moved to a location that is consistent with site selection guidelines. A shift of the Port Gardner site to the west would result in the site being in two shoreline jurisdictions (Island County and Snohomish County). There is insufficient data on natural resources to the north to support site movement in that direction. If moved to the northeast or east the site would not have the desirable 2,500-foot buffer zone between the site and important crab resources. The site cannot be moved to the south because of the Navy's RADCAD site.

During coordination with Mr. Williams he suggested that we consider a new site located west of Gedney Island that would avoid the unreasonable haul distance associated with use of the Saratoga Passage site (alternative III). The Gedney Island proposal was reviewed by the Disposal Site Work Group (DSWG). The group reported that an extension of the ZSF along the western edge of Gedney Island for siting consideration was considered in the original ZSF selection process conducted in 1985. However, a site in this location was dropped from further consideration for the following reasons:

a. Depths along the western channel of Gedney Island approach 100 fathoms or 600 feet, which DSWG had previously decided to avoid because of uncertainty with regard to bottom currents and the difficulty of environmental monitoring.

b. Secondly, a NOAA current meter mooring station west of Gedney Island (site 41, station 17, NOAA Technical Manual NOS OMS No. 3, Figure 11-6) located at a depth of 142 meters (bottom depth 157 meters) showed a total variance of 218.6 cm2/sec2 and a 1 percent fastest speed of 20 to 40 cm/sec, thereby indicating that the 1 percent currents in the area exceed the non-dispersive site selection guidelines of 25 cm/sec. By comparison, current meters moored at two sites in proximity to the preferred site in Port Gardner have recorded mean speeds of 5.5 to 7.2 cm/sec, a total variance of 105 cm2/sec2, and 1 percent speeds of 15.9 and 22.8 cm/sec respectfully, well within the nondispersive site selection guidelines that are intended to locate sites where dredged material will not be eroded. This facilitates environmental monitoring and site use accountability.

criteria and procedures and as the standards (and costs) of confined disposal are clarified, reevaluation and adjustment of the PSDDA process will result in the unconfined open water sites meeting site condition I.

Evaluation Procedures

1 The evaluation procedures utilize bioassays and bioaccumulation tests to make decisions about material to be dredged within a framework of chemical concentration criteria. The criteria (screening levels and maximum levels) are based on apparent effects threshold values. The Authority concurs with the proposed evaluation procedures with one exception. The PSDDA recommendation permits unconfined in-water disposal of sediments with chemical concentrations above the listed "Maximum" levels if the proponent carries out additional bioaccumulation and water column effects tests. But the management plan indicates that such material would probably not be accepted at the PSDDA sites. Instead, the proponent would have to identify another in-water site. The Authority feels that it is unlikely that any material exceeding the maximum levels would pass the regular bioassays and the additional tests. But if material exceeding the ML levels is allowed to be disposed of through unconfined in-water disposal, the PSDDA sites should be used. Proliferation of sites, especially to handle more-contaminated material, is undesirable.

Site Selection

Proposed sites were selected in several steps. Factors considered include depth, slope, sediment type, currents, biological resources, and conflicts with shipping and fishing traffic.

2 The Authority concurs with the preferred sites proposed in Elliott and Commencement bays. The Authority has concerns about the preferred Port Gardner site including possible harm to adult salmon, conflicts with fishing, and cumulative impacts due to the proximity of the Navy Confined Aquatic Disposal site. The PSDDA agencies should review the possibility of relocating the preferred Port Gardner site within the existing zone of siting feasibility to minimize these conflicts while balancing all of the other siting concerns, 3 including depth, current, and benthic resources. In addition, some estimate of the likely timing and frequency of conflicts with tribal fishing should be presented and possible timing restrictions to minimize conflicts should be considered.

Site Management -- Inspections and Positioning

The proposed site management program addresses procedures to ensure that only material that has been approved for unconfined open water disposal is taken to the sites as well as positioning of barges over the disposal sites. For non-Corps projects, Ecology will provide for inspections at the dredging site and DNR will provide for inspections at the disposal sites. For Corps projects, the Corps will monitor its contractors.

The Authority concurs with the draft proposal.

c. Other siting factors also precluded consideration of a site along the western side of Gedney Island. A 2,500-foot buffer from Gedney Island shorelines and critical natural resources, called for by the siting guidelines, would place a (4,000-foot diameter) site within the central channel and involve two shoreline jurisdictions (Island County and Snohomish County). Moving the site west, toward Whidbey Island, into just Island County jurisdiction, would violate 2,500-foot buffer zone criteria (i.e., natural resources and shoreline buffer zone) and place the site along a steep bathymetric slope, which would be unstable for placement of dredged material. Critical Gedney Island natural resources at risk are: (a) a bald eagle nesting area on the island; (b) eelgrass beds located off the southwest side of Gedney Island; (c) a major geoduck bed located along the eastern edge of Whidbey Island; and (d) Dungeness crab concentration areas surrounding the island (see DSWG overlay maps and Puget Sound Atlas).

An alternative site west of Gedney Island was dropped from further consideration by DSWG based on collective evaluation of all the siting factors used to locate nondispersive sites within Phase I areas. The siting factors eliminating a Gedney Island alternative site are still valid.

Response 3. The estimated frequency of dredging disposal activity is presented in the DEIS and FEIS (see sections 4.02c(3); 4.03c(3); 4.08c(3); 4.13c(3)). As stated in the FEIS there will be no conflicts between disposal activities and Indian fishing as these conflicts will be avoided by disposal restrictions (see FEIS section 2.05). Also see response No. 10 to the NMFS letter and response No. 2 to the Suquamish Tribe letter.

Response 4. The monitoring plan has been changed to include offsite biological stations for Elliott Bay baseline studies. The baseline data collected in May 1988 will be reviewed to determine if subsequent biological monitoring is useful. This review will be coordinated with the PSWQA and other interested parties. See the Management Plan Report (MPR) (chapter 7.3) and the Management Plans Technical Appendix (MPTA), exhibit I for changes to the monitoring plan.

Response 5. The monitoring plan has been changed to specify use of the Puget Sound Ambient Monitoring Program (PSAMP) two centimeter protocol for sediments sampled at the disposal site perimeter line.

Response 6. Monitoring stations have been placed between the Port Gardner preferred PSDDA site and the Navy's RADCAD site by both the PSDDA agencies and the Navy. Close coordination of respective ongoing baseline study activities is underway between these two programs to ensure that, should unforseen problems occur, the responsible parties can be identified. Consideration is also being given to delaying use of the PSDDA site until after the PSDDA baseline studies and mound construction in the Navy Phase I operation are completed. these data should provide "real world" information on potential offsite movement of sediment particles from the Navy site toward the PSDDA site. Delaying use of the PSDDA site per the foregoing would avoid complications in interpreting data that might otherwise result if simultaneous operations were occurring at the two sites. Also see response No. 14 to the NMFS letter.

Site Management - Monitoring

Extensive monitoring of disposal sites is proposed, including physical, chemical, and biological measures. The monitoring program has been customized for each proposed site. There is one major difference among three monitoring proposals. In Port Gardner Bay and Commencement Bay, stations are identified where bottom-dwelling organisms would be sampled to see whether the populations are changing and to measure bioaccumulation. This sampling is not proposed in Elliott Bay, based on the argument that Elliott Bay is already so seriously degraded and is subject to so many possible sources of contamination that (1) collecting these samples in Elliott Bay would never detect a difference, and (2) if a difference were detected, they might be caused by other sources of contamination.

4

The Authority feels that monitoring is at the heart of the PSDDA proposal. Monitoring in Elliott Bay should include the biological stations. The proposed Site Condition II would allow minor adverse effects to organisms on site but (in theory) would not result in any adverse effects off-site. Monitoring must be carried out off-site to confirm no effects. If results from off-site biological stations in Elliott Bay show high levels of chemical effects clearly not associated with the disposal site over several years time, then the biological sampling can be stopped. *It is understood that such sampling in Elliott Bay may have more "false positives" than the other bays.* But this is not adequate justification to decide not to look. It should be noted that the sediment monitoring component of the Ambient Monitoring Program will apply the "sediment triad" (including abundance of bottom-dwelling organisms) to sediment monitoring stations throughout the Sound. PSDDA should provide comparable monitoring at all PSDDA sites.

5

The chemical sampling of sediments on the disposal sites will collect samples 10 centimeters deep for analysis. PSDDA samples off-site for chemistry are proposed to include the top five centimeters. The off-site samples should conform to the two centimeter protocol being adopted by the Puget Sound Ambient Monitoring Program. Two centimeter thick samples will provide the best balance between sensitivity and repeatability.

6

The monitoring of the Port Gardner Bay site places the transect of biological stations to the northwest. Additional monitoring should be directed towards the Navy CAD site, at least for the first years, to improve our ability to differentiate between effects of the Navy disposal and the PSDDA site.

Data Management

7

A data management program is proposed for PSDDA with the Corps, DNR, and Ecology each playing a role. The Authority supports the plan and recommends that the PSDDA data management program be designed and implemented to be compatible with the database being developed for the ambient monitoring program. In particular, PSDDA should use consistent protocols for data coding, station identification, and data exchange so that the PSDDA data can

Response 7. Comment noted. The PSDDA monitoring program is being closely coordinated with the PSAMP and other related sediment quality data gathering programs.

Response 8. Comments noted.

be integrated with the ambient monitoring data.

Need for Local Government Shoreline Plan Changes

8

The EIS indicates that each of the proposed sites can be permitted without changes to local Shoreline Management programs. The PSDDA Phase 1 management plan includes a proposal that the three shoreline jurisdictions (Seattle, Everett, and Pierce County) each amend their Shoreline Master Programs to incorporate standard language concerning unconfined open water disposal sites. The proposed language clarifies the regional role the sites play and precludes the granting of shoreline permits for unconfined open water disposal except at the PSDDA designated sites.

The Authority agrees that a major purpose of the PSDDA program is to establish a limited number of sites, each of which would serve dredging activity within a region that includes several shoreline jurisdictions. This means that Seattle, Everett, and Pierce County will be issuing permits for disposal sites to serve economic development in other jurisdictions throughout central Puget Sound. All of the open water sites are at locations considered "Shorelines of Statewide Significance" where local governments must give particular consideration to uses which recognize and protect the statewide interest over local interest. The Authority agrees with the intent of the proposed Master Program language and will encourage the affected jurisdictions to review their Shoreline Master Programs and make changes as appropriate to implement the PSDDA program. Since the proposed PSDDA sites can be issued permits under the existing local Shoreline Master Program changes, the decision whether or not to adopt the language proposed by PSDDA should be left to the three jurisdictions.

In summary, the Authority supports the basic recommendations of the draft PSDDA Phase 1 reports. We thank you again for your efforts to bring this project to its present position. If you have any questions about these comments, please contact John Dohrmann (464-7318).

Sincerely,

Katherine Fletcher
Chair

STATE OF WASHINGTON

DEPARTMENT OF FISHERIES

21 3/7/88

March 1, 1988

Mr. Frank Urabeck
Department of the Army
Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Urabeck:

Draft Environmental Impact Statement (DEIS) and Draft Management Plan - Proposed Unconfined Open Water Disposal Sites for Dredged Material, Phase 1 (Central Puget Sound)

The Washington Department of Fisheries (WDF) has reviewed the above-referenced documents. The WDF has also been heavily involved in the entire Puget Sound Dredged Disposal Analysis (PSDDA) study since its inception. In addition, WDF has contributed considerable staff time supplying resource information, data analysis, and attending numerous meetings.

WDF will continue to supply input into all future dredging proposals in Puget Sound, through appropriate channels following completion of the PSDDA study, to ensure the protection of the salmon, marine fish, and shellfish resources of the state. This will be accomplished during the close review of all dredging proposals on a case-by-case basis where we will continue to spell out specific conditions, such as project timing and other necessary mitigative measures to ensure the proper protection of fish life (including shellfish) for each proposed project.

WDF agrees with the selection of the preferred non-dispersive sites in Commencement Bay, Elliott Bay, and Port Gardner. Our concurrence is based on assurance that Site Condition II is maintained and site monitoring ensures the criteria are not exceeded.

WDF requests this entire letter be included in the Final NEPA/SEPA EIS. Our detailed comments on the draft Management Plan and draft EIS are as follows:

Draft Management Plan

Chapter 2 (Background) of the proposed management plan describes concerns and interactions with the Indian fisheries (harvest related potential impacts). WDF concurs these matter must be addressed in the

1

RESPONSES TO WDF 1 MARCH 1988 LETTER

Response 1. The Management Plan Report (MPR) has been changed to indicate that fish and shellfish resources are discussed and impacts to harvests are evaluated in the FEIS for each PSDDA site (see MPR chapter 4.1). See FEIS, section 3.04c(5) for a discussion on non-Indian commercial and recreational fisheries in Port Gardner and section 4.13c(5) for a discussion of potential impacts. Dungeness crab resources in Port Gardner are discussed in the FEIS, section 3.04b(1)(c) and impacts evaluated in section 4.13b(3)(c). Pandalid shrimp resources in Elliott Bay are discussed in the FEIS, section 3.03b(1)(c) and impacts evaluated in section 4.08b(3)(c). Also see response No. 7 to the Suquamish Tribe letter. Commercial and recreational salmon fisheries (Native American and non-Indian) are discussed for each site and impacts evaluated at each site in the FEIS.

Response 2. The position of WDF is noted on the dredger option for performing additional biological tests when sediment chemistry exceeds ML values. See response No. 6 to Suquamish Tribe letter and response No. 1 to PSWQA letter.

Response 3. We concur with this comment. The text has been revised with the following addition to chapter 6 of the Management Plan report: "Dredging activities could also be discouraged during other periods of the year in those areas where sensitive life stages of fish (other than salmon) or shellfish species were occuring such that dredging during these periods would have unacceptable adverse impacts. Timing concerns involve such commercially important species as Pacific herring (during their spawning/egg laying stages) and Dungeness crab (during egg incubation and juvenile development periods). Other dredging projects in unique water quality areas may have timing restrictions if these areas are considered likely to experience seasonal reductions in water quality that could be exacerbated by dredging activities. However, there restrictions often increase dredging costs or impact dredging effectiveness. Such restrictions could impact certain projects by increasing costs to the point where dredging is no longer justified. This in turn could have social and economic consequences."

Response 4. Comment noted. Citation in MPR has been corrected.

Response 5. Fish and mobile shellfish may move considerable distances during a year. In or near urban centers with sources of pollution, these species may obtain chemicals of concern from a variety of sources. The information developed during the resource inventory phase of PSDDA indicates that both crab and shrimp abundance varies seasonally around the proposed disposal sites. This would indicate that shellfish move about the area throughout the year possibly exposing themselves to chemicals of concern from other sources. Major physical impacts of disposal activities would be largely confined to that portion of the Elliott Bay site lying below the 1,800-foot-diameter disposal zone. This is downslope from shrimp and bottomfish resources and the higher biomass and diversity which occurs in the shallower stations at the south end of the disposal site. Commercially important flatfish species

1 PSDDA study along with potential impacts to other fish or shellfish harvest such as commercial trawl fisheries in Port Gardner (whiting), commercial and recreational harvest of Dungeness crab in Port Gardner and potential commercial and recreational harvest of pandalid shrimp in Elliott Bay. All commercial and recreational salmon fisheries should also be discussed for all PSDDA sites.

2 Chapter 5 (PSDDA Dredged Materials Evaluation Procedures). In general, WDF concurs with the PSDDA Evaluation Procedures. They are an intricate system to test and manage dredging and disposal of materials containing various levels of chemical contamination. The system reflects the time commitment and expertise involved in its development. It is based on a number of assumptions concerning the relationship between the field or laboratory results and the ultimate effects of the material in the environment. To affirm these assumptions, monitoring and accountability relative to the ultimate fate of the material will remain a crucial issue. We take exception to one portion. Disposal of material above the ML or Maximum Level should not be permitted for individual projects even with additional testing. With that exception, we feel the system has a high probability of providing acceptable environmental protection if followed in its entirety.

3 Chapter 6 (Disposal Site Management). WDF appreciates the statement "Dredging activity is generally prohibited by WDF regulations from March 15 to June 15 each year." We believe this section should also mention WDF dredge timing concerns throughout Puget Sound which will affect certain dredging (indirectly affecting disposal in PSDDA Phase 1, Phase II or upland sites) such as Pacific herring spawning activities, surf smelt spawning activities, and critical periods of Dungeness crab life history. In addition, certain potential dredging projects in unique water quality areas like Olympia Harbor may have different timing restrictions (e.g., Olympia Marina). This should be mentioned under PSDDA Phase I and Phase II in case water quality, for example, changes because of municipal discharges or low river flow conditions (drought) or when new resource information is obtained.

4 Of minor note in Chapter 6 Hydraulic Project Approval, please correct "RCW 76.20.100" to read "RCW.75.20.100" and note the purpose of the statute is to protect fish life which also means to protect fish habitat.

5 Chapter 7 (Disposal Site Environmental Monitoring). The Executive Summary, page ES9, states, "The monitoring plan is intended to ensure that acceptable conditions at the site are not exceeded and to provide a basis for any necessary plan adjustments." WDF believes the only way these objectives can be met is through continued monitoring of economically important fish and shellfish resources found on or near the

(Dover sole, English sole) are more abundant at the alternative site than the preferred site.

Although a limited commercial spotted shrimp fishery does exist in Elliott Bay, catches have been very low in recent years and this may be a consequence of sediment quality degradation in Elliott Bay. There are other possible reasons that the Elliott Bay fishery is poorly exploited. The shrimp and bottomfish resources in inner Elliott Bay are located near or in ship anchorage areas where there is considerable marine traffic. A recent sidescan survey of the preferred site disclosed shipwrecks and other obstructions to nets which would also make commercial trawling difficult. *Donnelly, et al.* (1986), assessed the two Elliott Bay alternative sites and concluded that disposal of dredged material at the alternative nonpreferred site near Fourmile Rock would have more impact on commercial flatfish trawling than at the preferred inner bay site.

Bioassays conducted on sediments sampled from the disposal site will provide a measure of biological effects. While we do not anticipate any offsite movement of sediments or chemicals, we have added offsite biological stations to the baseline effort and will continue there if baseline data support their use in subsequent environmental monitoring. Physical disturbance from disposal operations will drastically alter the benthic community structure, depress species diversity and temporarily depress species abundance. Benthic species eventually recolonizing the site may be more valuable and available to demersal predators although their abundances are expected to be low during disposal periods. Recruitment of benthic colonizers during other periods may result in localized enhancement of the benthic community to predators, although the PSDDA sites are generally in areas of low concentrations of demersal finfish and shellfish.

The intent of this comment, as clarified by the WDF representative to the Evaluation Procedures Work Group in April 1988, was to encourage the PSDDA agencies to participate in the PSWQA ambient monitoring program by adding epifaunal trawl stations to the overall PSWQA program. While this may be useful to the ambient monitoring program, funding resources are not available from dredging activities to support this effort. The monitoring planned for the PSDDA sites is sufficient to verify that site management objectives are being met.

Response 6. Comment noted. Text has been changed.

Response 7. Comment noted. Text has been changed.

Response 8. Comment noted. We accept your comment that the lack of viable commercial shrimp fishery in Elliott Bay is due to the lack of shrimp abundance necessary to support a fishery, but feel that the poor sediment quality in Elliott Bay may also be a contributory factor to shrimp viability and reproductive success, thereby leading to a population decline in recent years. We acknowledge that this is a speculative cause and not a proven one. Also see response No. 5 above.

disposal site once disposal begins. Examples of these resources are Dungeness crab and pandalid shrimp in Port Gardner, and pandalid shrimp in Elliott Bay. 5

On page 7-2 the authors state, "Mobile species are not expected to gather at the active disposal sites for long enough periods of time to warrant epifaunal trawls as part of the PSDDA monitoring plan." We cannot concur because the trawl surveys have already established that commercial quantities of pandalid shrimp occur on the proposed Elliott Bay site and that high concentrations of Dungeness crab occur near the proposed Port Gardner site. The disposal material may contain prey items which will attract crab and shrimp at certain times resulting in unanticipated damage to these resources. WDF believes complete monitoring for several years must be conducted to meet the goals stated in the Executive Summary.

<u>Draft Environmental Impact Statement (DEIS)</u>

Page 3-6; 3-7. We note the descriptions of the benthic communities are taken from the Elliott Bay Small Craft Harbor EIS. We believe this is appropriate for certain general information but does not adequately describe benthic shellfish for all of central Puget Sound. For example, Dungeness crab and geoducks are listed as "occasional residents". Dungeness crab abundance is extremely high in Port Gardner and about one-third of the state's commercial harvest of geoduck and hardshell clams is taken in Central Puget Sound. Pandalid shrimp are found in commercial quantities in Port Gardner and Port Susan. Pandalid shrimp abundance should be specified as "near commercial abundance" in Elliott Bay. 6

Page 3-92. There appears to be some confusion on non-Indian commercial and recreational catches of Dungeness crab for Port Gardner. We believe a more realistic figure to be over 55.000 lbs. per year. 7

Page 4-68. Under mobile crab and shrimp resources, the authors state, "Fall densities could conceivably support a limited commercial or recreational shrimp fishery were they not located in a very high boat activity and harbor area in inner Elliott Bay." We cannot accept the implication a harvest could not take place since historically a fishery did occur. Also, if the shrimp population increased an economical, successful fishery would occur. Examples include Fidalgo Bay, Port Gardner and Port Angeles. The authors also suggest shrimp taken at the preferred disposal site might have little commercial value because of high sediment chemical levels. We believe it is the lack of an adequate level of shrimp abundance to warrant a commercial fishery and not a speculative potential for bioaccumulation of chemicals from the sediments that now results in a lack of a fishery. 8

We appreciate commenting on these documents and look forward to continued involvement in the PSDDA study. If you have any questions on this letter, please contact Mr. Randy Carman at (206) 753-2908.

Sincerely,

Duane E Phinney
for Joseph R. Blum
Director

JRB:EF:db

cc: DOE
DNR
EPA
WDW

cc: TSC

2/26/88

METRO
Municipality of Metropolitan Seattle
Exchange Building • 821 Second Ave. • Seattle, WA 98104-1598

February 23, 1988

Frank Urabeck, Director
Puget Sound Dredged Disposal Analysis Study
US Army Corps of Engineers
Seattle District
P. O. Box C-3755
Seattle, Washington 98124-2255

Draft Environmental Impact Statement
Proposed Management Plan for Unconfined Open-Water Disposal of Dredge Material

Dear Mr. Urabeck:

Metro staff has reviewed the Draft EIS for the Proposed Management Plan for Unconfined Open-Water Disposal of Dredge Material, and offers the following comments.

Metro's primary concerns center around the dredge disposal sites in Elliott Bay and the potential environmental changes around Metro's Renton outfall and diffuser. The dredge spoil disposal activities would introduce an additional source that may affect Metro's ability to differentiate the environmental changes resulting from secondary effluent from that of other sources. The difficulty in identifying the source of environmental change(s) will compromise Metro's ability to manage NPDES permit requirements and to take appropriate corrective actions, as necessary.

Metro recently completed a three year (1984-86) environmental baseline study around the Renton outfall off Duwamish Head in outer Elliott Bay. The $1.6 million baseline study was developed to document predischarge physical, chemical and biological conditions around the outfall site. These data were used to develop a postdischarge NPDES environmental monitoring program.

Postdischarge monitoring data collected from the start of operation of the Renton outfall in March, 1987, will be compared with the predischarge environmental conditions to assess any environmental change(s) resulting from the Renton secondary effluent discharge. As mentioned previously, if environmental

changes(s) are detected in the vicinity of the outfall, environmental data interpretation of multiple source impacts may be so difficult that Metro's ability to determine if the secondary effluent discharge was the primary cause of the environmental change(s) will be greatly reduced.

1

Metro staff strongly recommends the principal agencies develop and implement a monitoring program to evaluate potential dredge spoil disposal impacts on adjacent area, as a means to determine specific sources of environmental change(s).

Review of the Technical Appendix Management Plans shows the logic and proposed monitoring plan narrative sections were comprehensive and well designed.

2

However, close examination of the actual monitoring plan details; i.e., Tables, for the Elliott Bay disposal site revealed a minimal and quite inadequate baseline sampling plan. Onsite sampling appears to be adequate, but no offsite baseline monitoring was proposed for the Elliott Bay disposal site. This baseline data would appear to be necessary for assessing potential offsite environmental impacts resulting from dredge spoil disposal.

If PSDDA is planning to use existing data, where available, for the baseline data base, care must be taken to ensure that field sampling and lab analytical methods are comparable.

The two reference stations for the Elliott Bay site are located in areas designated as toxicant hotspots by the EPA, Elliott Bay Toxics Action Program. "Polluted" reference station data could result in no significant environmental impacts when used for comparison with the Onsite monitoring results.

Robert Matsuda (684-1218) of Metro's Marine Assessment Group is available for further discussion of these comments.

Thank you for the opportunity to review and comment.

Sincerely,

Gregory Bush

Gregory M. Bush, Manager
Environmental Planning Division

GMB:jmg

cc: Robert Matsuda

RESPONSES TO METRO 23 FEBRUARY 1988 LETTER

Response 1. Comment noted and appreciated.

Response 2. Offsite biological stations were originally not planned for Elliott Bay, due to the number and distribution of pollution sources within the bay. The PSDDA agencies concluded that the data resulting from those stations would be confused by the pollution sources. However, some recent data suggest that this may not be true. Accordingly, offsite biological stations have been added to the baseline effort. These stations will be continued for subsequent environmental monitoring if the baseline data support this action. The purpose of the reference stations (now referred to as background "benchmark" stations) is to enable a determination of whether or not chemical changes at a disposal site are due to outside pollution sources and/or natural occurrences in the area.

R 2/26/88

City of Bellevue
Storm & Surface Water Utility 455 7846
Post Office Box 90012 • Bellevue, Washington • 98009 9012

February 26, 1988

Department of the Army
Seattle District Corps of Engineers
P. O. Box C-3755
Seattle, WA 98124-2255
Attn: Frank Urabeck

Dear Mr. Urabeck:

The City of Bellevue has reviewed the Draft Environmental Impact Statement entitled "Proposed Unconfined Open-Water Disposal sites for Dredged Material, Phase I (Central Puget Sound). We offer the following comments:

1. Does the forecasted dredging volume estimates contained in Table 1B considered any dredged spoils from Lake Washington? In the Coal Creek Basin Plan and Environmental Impact Statement it has been estimated that approximately 70,000 cubic yards of delta exist which may need to be disposed. An open water disposal site would be the preferred location.

2. Another delta exists in Lake Washington in Meydenbauer Bay. No estimate for the volume of this delta is available at this time.

According to our estimates the cost to dispose of the delta from Coal Creek into an upland site is three times greater than in an open water site.

We request to be kept on your mailing list for the final environmental impact statement for this project.

Sincerely,

Damon Diessner
Director
Storm and Surface Water Utility

cc: Storm and Surface Water Advisory Commission
Doug Warne

TSC

City of Bellevue offices are located at Main Street and 116th Avenue S E

RESPONSE TO CITY OF BELLEVUE 26 FEBRUARY 1988 LETTER

Response. While the city of Bellevue proposed projects were not specifically included in the forecasted dredging volumes, an allowance for dredged material that will be generated by those seeking and gaining Section 404 permits, such as the city of Bellevue, is reflected in the volume forecasts. Actual use of the Elliott Bay site will depend on the results of the 404(b)(1) evaluation and other requirements of the regulatory process (see chapter 1 of the Management Plan Report). We fully recognize that upland disposal is usually a much more costly disposal alternative.

KJ 3/4/88

PORT OF Everett

March 1, 1988

Mr. Frank Urabeck
Seattle District Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Dear Frank:

The Port of Everett appreciates the opportunity to comment on the Draft EIS on the proposed unconfined open water disposal sites for dredged materials, Phase I area, Central Puget Sound, Puget Sound Dredged Disposal Analysis.

These initial comments will be general and will be followed up by more detailed comments being developed jointly with the Port of Tacoma.

Disposal Sites

The Port of Everett supports the designation of the preferred Port Gardner disposal site. Our understanding is that weak bottom currents exist at this location and the area is a depositional environment. Shrimp, bottomfish and crab use of the site is low and considerably less than sites closer toward shore. The site is close to the center of dredging activity in the Everett Harbor.

1

We also understand that because the sites are in deep water, there will be no conflict with the Tulalip Fishery. Actual dumping of the dredged material can be conditioned so as not to impact ongoing fishing activities.

The PSDDA process allows us to continue partial disposal of dredged material. We still are confronted with no acceptable disposal sites for material which is unacceptable for open water disposal. We strongly support the effort by the Department of Ecology to develop a process for disposal of material unacceptable for open water disposal.

Evaluation Procedures

2

The Port reluctantly supports adoption of the evaluation procedures related to PSDDA. We are greatly concerned about the high cost of testing and general lack of scientific data supporting the criteria. We support the development of Pilot studies and will provide followup comments relating to guidelines for such studies.

Mr. Frank Urabeck
March 1, 1988
Page Two

The development of a users manual is critical in view of the complex nature of the PSDDA processes. 3

Our detailed comments will be submitted by March 11, 1988.

Sincerely,

Philip B. Bannan
Executive Director

PBB:lj

cc: Dennis Gregoire

RESPONSES TO PORT OF EVERETT 1 MARCH 1988 LETTER

Response 1. Comment noted.

Response 2. Comments noted. While we acknowledge that PSDDA may result in higher testing costs than have been recently experienced (see Managment Plan Report (MPR) chapter 5.6.1), we view the procedures as being supported by the best available scientific data. However, we recognize that testing procedures are evolving and that our knowledge of sediment chemistry and biological conditions in the Puget Sound area is rapidly expanding. Accordingly, we have included a data collection and management system in the PSDDA management plan that will allow us to assess the effectiveness and cost reasonableness of our dredged material evaluation procedures and to consider changes as part of an annual review in which the ports are encouraged to participate. Our management plan has been revised to include a dredger option for pilot studies (now referred to as partial characterization studies - see MPR chapter 5.6.3) which may help reduce the cost of sampling and testing.

Response 3. Comment noted. Ecology is preparing a user's manual that will be available to ports and other dredgers for planning dredging projects. This manual is currently expected to be available in draft form by November 1988.

PORT OF Everett

March 11, 1988

Mr. Frank Urabeck
Seattle District Corps of Engineers
P.O. Box C-3755
Seattle, WA 98124

Dear Frank:

As a followup to our letter of March 1, 1988, the following additional comments are provided on the PSDDA Draft EIS and proposed Draft Management Plan.

Evaluation Procedures

The Port of Everett supports the *site condition II management* condition. However, because of the assumptions supporting this criteria, we feel future monitoring will demonstrate higher performing disposal sites, and thus justification to adjust the chemical and biological standards. (See Attachment A, pgs. 5 & 6.)

The enclosed Attachment A provides specific comments on the Draft PSDDA EIS, Draft Evaluation Procedures, and Draft Management Plan; developed jointly with the Port of Tacoma.

The Port of Everett is also proceeding in Attachment B, a set of guidelines for a PSDDA Pilot Study. This procedure is one option that needs to be available for the dredger.

We appreciate the opportunity to comment, and look forward to working on the implementation of the PSDDA procedures.

Very truly yours,

Philip B. Bannan
Executive Director

Attachments: A & B

PBB:lj

PORT OF TACOMA/PORT OF EVERETT
JOINT COMMENTS ON DRAFT PSSDA EIS

GENERAL COMMENTS

o We support designation of the selected disposal sites.

The Commencement Bay site is removed from high value habitat areas and its benthic resource values are low. No crab were found on the site and shrimp and bottomfish use of the site were very low. Additionally, this site lies in an area where sediments appear to be stable and nondispersive and more depositional in nature than the alternative site. Additionally, this site is a little closer to the center of dredging than the alternative site.

The Port Gardner site lies in an area of weak bottom currents and is a depositional environment. The site is substantially buffered from the high value crab and bottom fish area in Port Gardner. Shrimp, bottomfish and crab use of the site is low and substantially less than sites closer towards shore. The prevailing low current flow in the area is to the north and westward directions, thus assuring that suspended material moves away from the high value habitat area in Port Gardner Bay. The site, although not the nearest site, is reasonably close to the center of dredging.

1

o Because both the Commencement Bay and Port Gardner sites are in deep water, there is little conflict with the Indian fishery. The primary conflict would be involved with salmon which live in the water column generally near the surface. The only expected impact on the salmon would be from turbidity and suspended solids entering the water column during dumping operations. It is believed that salmon will tend to avoid such turbidity plumes. However, even if they can't, the time of exposure is low. Impacts are expected to be low.

The main potential for conflict occurs if fishing is ongoing at the disposal site when dumping is to take place. The EIS states that each individual dredging permit should be conditioned as necessary to avoid such conflict. We believe this to be a reasonable mechanism for handling such a situation.

o There are extreme difficulties associated with disposal of material which has been found to be unacceptable for open water disposal. Typically the disposal sites are upland or nearshore sites. The CAD technology is in its infant stages in Puget Sound. Additionally because of site constraints (environmental, depth, and low

2

ATTACHMENT A

Everett/Tacoma comments
on PSDDA

RESPONSES TO PORT OF EVERETT ATTACHMENT A
(JOINTLY PREPARED WITH PORT OF TACOMA)
OF 11 MARCH 1988 LETTER

Response 1. Comments accepted.

Response 2. Comments accepted. Work on confined disposal standards is underway by Ecology with a siting feasibility study to be initiated this summer. See response No. 14 to Port of Tacoma letter.

Response 3. We agree with your comments. Ongoing work by EPA Region 10 and PSDDA Phase II studies have already resulted in adjustments to the screening level (SL) and maximum level (ML) sediment quality values. These are reflected in the Management Plan Report (MPR) and Evaluation Procedures Technical Appendix (EPTA). On a case by case basis, we fully expect to eliminate certain chemicals from testing requirements once an adequate data base has been established and there is no reason to believe those chemicals are present or present in concentrations exceeding SL values. Also chemicals may be excluded from full characterization studies based on the results of partial characterization (see MPR chapter 5.6.3 and EPTA section II-5.2.4).

Chemicals of concern, that have been shown to be absent from a dredging area, may be excluded from analysis (see MPR chapter 5.5.1). Existing information will be assessed during the first tier of the evaluation procedures. Some adjustments to the SL and ML values, to accomodate areas where background levels are naturally high (e.g., certain metals in the northern portions of the sound), have already been made. Other changes will be made during the annual reviews as information becomes available.

Response 4. Comment noted. We have added guidelines to the PSDDA evaluation procedures that allow for partial characterization of sediments in a project area (see EPTA section II-5.2.4). Partial characterization is a means of obtaining some data on project area sediments that may allow the regulatory agencies to down rank the project area in terms of the full characterization sampling and testing requirements. This may reduce a dredger's cost appreciably. A proposed pilot study guideline developed by the Port of Everett was considered by the Evaluation Procedures Work Group (EPWG) in the development of the partial characterization guideline.

Response 5. The EPTA contains guidelines for relating sediment chemical testing data to area ranking (see response No. 4 above). These guidelines will enable areas to be reclassified where new information supports the reclassification.

Response 6. We agree that a user manual is needed to facilitate the implementation of PSDDA. A user manual is currently under development by Ecology. A draft of the manual is scheduled to be released for public review by November 1988.

energy) the overall availability of suitable sites is poor. There will continue to be great difficulty in securing approval for these sites.

2

The Ports currently, as a result of PSDDA and previous criteria, must secure and develop acceptable disposal mechanisms for contaminated material not suitable for open water unconfined disposal. Because of the lack of guidance, these procedures have been developed on a site specific case by case basis.

The results have been far from satisfying for the Ports. Currently the dredger is required to take all the risk with little confidence that future regulations may not change resulting in additional handling with associated costs of the confined material. In order to add predictability, thereby allowing for reasoned decision making on the part of Ports and others, it is vitally important that procedures be developed for confined disposal.

The Washington Department of Ecology (Ecology) is currently undertaking this process. We support Ecology's efforts and would like to work closely with them in the development of these standards. We also encourage Ecology to accelerate its time frame for identifying acceptable multi-user disposal sites. The currently proposed schedule will not result in designation of sites until at least 1992. Several major projects currently under planning will be affected prior to that time.

It is recommended that the site designation process be greatly accelerated and, if possible, that sites be designated in conjunction with the upland disposal standards. This effort is the obvious missing link of PSDDA. Once completed, the total spectrum for handling dredged material, clean or contaminated, will have been established.

EVALUATION PROCEDURES TECHNICAL APPENDIX

- Additional research is necessary to more precisely identify screening and maximum level chemical standards. PSDDA recognizes this and is proposing a variety of studies for accomplishing this task. The Ports want to work with the agencies in the implementation of these tasks.

3

- Provision should be made for removing or adding a chemical of concern for sediment testing based on the area in which the sediments are being dredged. For example, some chemicals have only been found in specific geographical areas usually resulting from a specific existing or past industrial activity. If initial chemical testing for the PSDDA parameters from other areas of the Sound supports these findings, serious consideration should be given for eliminating or greatly reducing the frequency of testing of such chemicals except from the locations where they have been previously found. As spatial patterns for chemicals are determined, requirements for testing should be modified accordingly. Conversely, where background levels are naturally high, screening levels should be reconsidered.

4

- Page II-46 Pilot Studies: Use of pilot studies to better define the level of concern of the area being dredged may be one approach to reduce costs associated with sampling and testing yet still provide sufficient data for decision making purposes. Currently the procedures for analyzing pilot study results are not well defined. The number, extent and type of sampling needed to modify the level of concern should be specified. Currently a dredger undertaking a pilot study has no assurance, regardless of results, that the level of concern for the area will be modified.

5

- In areas where "Superfund" cleanup is indicated, or in situations where other urban bay action programs are underway, once these actions are completed, areas should be automatically reclassified to low concern in recognition of the strict cleanup standards, and the extensive evaluation which accompanies such action. This is to avoid duplication of studies. Similarly, in the course of normal project dredging, if data show that contamination is removed by the dredging action, the project boundaries should be automatically reclassified as part of the permit process.

6

- It is imperative that the users manual be developed as soon as possible. Because of the complexity of the PSDDA processes, a small document identifying the critical components of "how to do it" is vitally important to

applicants and consultants who must perform the work. This document will help reduce the number and length applicant-agency meetings which now are necessary during the case by case project review. 6

o Page II-58, 60 - It is indicated that long term storage of sediment samples prior to biological testing is not allowed because toxicity responses may increase (or sometimes decrease). It is further hypothesized that increased toxicity resulting from storage is caused by changes in the physical structure of the sediments.

Studies should be undertaken to determine what the statistical degree of difference in toxicity between the frozen and unfrozen sediments is. Additionally, studies should be run on sediments to determine whether frozen sediments (if frozen and then unfrozen and reintroduced to a water environment, stirred and aged) act in statistically similar manner to unfrozen fresh sediments. 7

If either one of these approaches or some other storage method can be found, large cost savings can be realized. Currently because of the short time period (4 to 6 weeks) for storing sediments for biological analysis coupled with the lengthy time period (usually greater than one month) for completing chemistry laboratory analyses, the ability to determine which sediments to run biological analyses on cannot be done. The dredger must choose between two unsatisfactory options; run the biological analyses for all samples regardless of chemistry results (ie potential for results to be either above the ML or below the SL), or remobilize and collect the necessary samples for the biological analysis. Both options are very expensive and the second option (usually the preferable option to the dredger) is of concern to the agencies because future modification or refinement of the ML standards is dependent on comparison of chemistry and biological impacts associated with the same, not different sediments.

o The proposed biological analyses are based on comparison both to controls and relatively uncontaminated reference sediments. Scientifically this approach is valid, however, the option should be given to the dredger to run his biological analyses with comparison only to a clean sediment control. This likely will constrain the tests such that they are more restrictive (ie tend to cause more material to fail) but will be of potential cost savings. If results from this modified procedure result in failure of the sediments for open water disposal and the failure is marginal in degree, the option for reanalyzing the sediments with comparison to reference sediments should be allowed. In many and perhaps most cases the lesser testing procedures, absent reference 8

area comparison, should provide sufficient results for decision making purposes. 8

o Page II-84 It is indicated here that reduction in the routine chemicals of concern list may be considered as a future research effort and is a possible topic for the periodic yearly reviews. We understand that the EPA Puget Sound Estuary Program (PSEP) is currently funding studies as part of its sediment quality values studies to determine which of those chemicals being analytically detected are causing biological problems and which are not. If a chemical is present but at a "noise" level (not causing harm), there would be justification to eliminate that chemical from further testing. 9

o The Ports believes it is imperative that yearly reviews occur during which all new individual project sediment testing and disposal site monitoring data is analyzed and assessed. The Ports would like to be an active participant in these meetings. Examples of issues which should be addressed in these sessions include:

A. Identification of those chemicals of concern being tested for which the Screening Level criteria is not being exceeded. Once identified these chemicals should either not be tested for or tested for much more infrequently. 10

B. Identification of those chemicals which are generally found together. If correlation can be made, a surrogate chemical should be selected for testing and the other chemicals tested infrequently or not tested at all.

C. Determine the sensitivity of the various bioassays. If it is determined that one of the bioassays is generally less sensitive to pollutants and is not affecting decisions regarding in water disposal (eg. it generally shows the material to be safe when other tests predict harm), the frequency for this bioassay test should be greatly reduced or eliminated.

D. Based on the surveys at the disposal sites, if chemical and biological testing shows that the site is performing better than the criteria (eg. Chemistry values are lower than the most contaminated sediments permitted for discharge and/or chemistry values are lower than category II levels and chronic and acute biological effects are not occurring), there should be relaxation of the chemical and biological standards to allow for greater amounts of material to go to the site. The initial situation is not unreasonable and in fact is expected. On page 2-36 of the EIS it is stated that "Because acceptable sediments will be 11

11

discharged at the disposal sites, the aggregate condition of each site is expected to be substantially better than allowed under the proposed management condition (site condition II)."

Several factors are expected to contribute to this situation including:

1) Testing procedures are more intense for and biased towards the generally more contaminated surface materials.

2) The mixing and capping effects of the subsurface material, which would generally be dredged last, are not accounted for.

3) Much of the material approved for open water disposal is substantially cleaner than the standards.

The issue of concern relates to actual exposure by the organisms living at the water sediment interface. If monitoring at the site indicates that this exposure is minimal and not of concern, the criteria should be relaxed to allow for disposal of more contaminated material at the disposal sites.

12

o Page II-102, Table II.7.2 - Laboratories generally are able to perform analyses cheaper, the higher the detection limits. In this case, the detection limit for most of the heavy metals is substantially more stringent than either the proposed SL or ML levels. For example the detection limit for lead in sediments is recommended at 0.1 ppm yet the SL level is proposed at 70 ppm. A detection limit in this case of over 1 ppm would safely characterize the sediments at a potential cost savings to the dredger.

Laboratories should be asked what the cost differential, if any, is at the different detection limits. If the differential is great and overall decision making will not be adversely affected, then there is justification for relaxing the detection limits. It's important to recognize the shift to laboratory certification now provides much greater assurance of sampling accuracy, and that the capability to go to extremely low detection limits is not in itself as critical. Limits suggested come from PSEP protocols, are suggested as goals-- not as standards, and in many circumstances are simply not achievable. Relatedly, we understand many PSEP methods are not yet validated.

13

o Page II-111 - In the example given it is indicated that both tests are statistically different from reference.

Response 7. We agree that research on the consequences of sediment storage to bioassay toxicity response is needed. The Corps Waterways Experiment Station (WES) is conducting such research for the New York District Corps office. That research will be reviewed when it is available.

We recognize that laboratories may not always be able to provide a normal 3- to 4-week turnaround, because of other work load and priorities. This is why 6 weeks is the currently maximum recommended holding time. See response 24.

Response 8. The sensitivity of the bioassay species to fine-grained sediments and chemical constituents associated with fine-grained sediments (e.g., sulfides) strongly suggests that sedimentologically similar reference sediment is needed to avoid unnecessary "failure" of the dredged material. Eliminating use of reference sediments may achieve some cost savings in testing. However there also is the risk of added disposal costs if failure occurs. Relying solely on control sediments would be most appropriate when assessing dredged material that is relatively coarse grained. The text in the MPR and EPTA reflect this option.

Response 9. We agree that chemicals that are not present in bioeffective amounts do not merit continued testing. Additional information being obtained by the ongoing EPA sediment quality studies may allow for these adjustments.

Response 10. The review of SL values, the sensitivity of bioassays, surrogate chemicals, and other topics are appropriate to address during the annual review of the PSDDA evaluation procedures in which the ports and all other interested entities are encouraged to participate.

Response 11. Comments noted. Test results, site monitoring data, and costs will all be considered during the annual reviews of the PSDDA management plan.

Response 12. An informal review conducted during the PSDDA study, of the cost of metals analysis, relative to required detection levels, indicated a very limited savings potential. This is because metals analysis is a relatively minor component of chemical testing costs. We agree that, for the purposes of dredged material assessment, detection limits well below the SL values are not reasonable. The EPTA and MPR exhibit A have been clarified on this issue. Standard protocols are needed, however, to ensure data comparability. Existing protocols do imply certain detection limits for metals.

We agree that the issue of detection limits deserves further assessment and anticipate that the ongoing Puget Sound Estuary Program (PSEP) update of the Puget Sound protocols will address this issue.

The PSEP protocols received extensive peer review prior to their adoption in local regulatory programs and have been utilized by local testing laboratories (who participated in their development).

What is the statistical formula used or recommended to be used to make this statement? Also for example are the following hypothetical values statistically different? (13)

10 (mean) +/-6 statistically differant from 12 (mean) +/-10 or,

10 (mean) +/-6 statistically different from 16 (mean) +/-14 or,

10 (mean) +/-6 statistically different from 20 (mean) +/-5?

- Many of the biological and chemical tests proposed by PSDDA are either state-of-the-art or have not been regularly tested for in dredging projects in the past. Because of this there is a real chance that for the next several years unanticipated difficulties in achieving compliance with the proposed PSDDA conditions will be discovered. Flexibility should be built into review procedures to handle these potential problems quickly. (14)

- Specific comments on problems and costs we see at this time with bioassays are as follows: 1. A relatively large volume of material (about 4 liters) is needed to conduct tests. According to our consultants, there is no readily available method to obtain below surface sediments. Multiple core samples may be one solution, but will increase costs. 2. The 10 day bivalve sample methodology is not well developed at this time. Methodology needs to be further developed and validated. Agencies should fund development and validation of protocol and methods. 3. PSSDA suggests microtox saltwater testing. PSEP suggests using solvents. There is currently no protocol for saltwater. This protocol should be developed, distributed, and validated before this method is required. 4. Costs per bioassay are high. Our latest price quote for required bioassays is a minimum of $2600 per sample (laboratory cost only-no interpretation). This cost is in addition to the estimated $1000 cost for sampling the usually required chemical parameters. Moreover, if bioaccumulation tests are required, such tests are estimated to cost $2600 per sample, plus cost for chemical sampling of tissues for whatever parameters are to be evaluated. 5. We still have serious concerns concerning the validity and application of the AET concept as a regulatory tool. We believe this concept is still in the developmental stages, should be viewed strictly as a criteria, and should not be assumed final. (15)

- Page II-117, footnote (a) - This footnote affects the SL and/or ML for 12 separate chemicals. Additionally, PSDDA strays from its recommended approach of establishing the (16)

Response 13. During development of the biological disposal guidelines, it was recognized that statistical significance could be calculated a number of different ways. Currently the regulating agencies expect to specify, a "t" test using $p = 0.05$ as the usual method for determining statistical significance. The user manual will address this issue. However, none of the examples provided in the comment are statistically different.

Response 14. The PSDDA management plan recognizes the need for flexibility (see sections 5.5.10 and A.10 of the MPR, and sections I-2.4 and I-2.5 of EPTA). As new information becomes available the evaluation procedures will be reassessed. The PSDDA biological tests have all been applied to Puget Sound sediments and are considered sufficiently developed for regulatory use. We have established a data collection and management system which will provide the basis for annual reviews and reassessments of the specified tests.

Response 15. Multiple coring is anticipated as the best method for collecting necessary volumes of subsurface sediments. In many cases, a single core can be divided into several subsurface samples that are composited prior to analysis. The compositing step usually provides more than enough volume.

Ongoing bioassay work funded by PSDDA during Phase II of the study is developing test methods to be used with the juvenile clam test. Study results should be available this fall.

The protocol for conducting saline extract microtox testing is contained in the current version of the Puget Sound protocols.

We recognize that the cost of conducting multiple biological tests is substantially above past practices. For this reason, a tiered testing approach is suggested which allows the results of chemical tests to be evaluated to determine the need for biological testing.

In developing the PSDDA screening and maximum level values, sole reliance was not placed on the AET values. Rather, separate numbers are sug- gested for environmental protection (screening levels) and cost effectiveness (maximum levels). Both past and recent analysis of these values indicates they are reliable predictors of the presence or absence of toxicity in biological tests. See section II-7.3 and II-7.4 of EPTA for a discussion of the SL and ML reliability.

Response 16. The changes to the ML values requested by this comment have been made in the guideline values listed in MPR exhibit A and EPTA. Some changes have also been made in the SL values. Pending completion of ongoing EPA sediment quality values studies, additional changes may be possible during Phase II of the PSDDA study.

Response 17. The ML value for nickel has been raised from the highest definitive AET value (49 ppm) to the highest "greater than" AET value (120 ppm). We acknowledge that guideline values for nickel, and other naturally occurring

ML2 level based on the high AET for these chemicals because the high AET in these cases is a greater than value. In these cases the highest definitive AET was selected. This is very conservative especially when a case can be made for making the ML2 level even greater than the greater than value currently identified for the high AET. 16

We recommend that the greater than value identified for the high AET for these chemicals become the ML2 value and the other values including the SL values be changed accordingly.

To support this recommendation further is the case example for the parameter of Nickel. Currently as proposed, the ML2 value of 49 ppm will prevent a substantial amount of dredging in Puget Sound. Specifically, most of the bottom sediment core samples for the Navy project in Everett representing "native" sediments exceed the 49 ppm value. Additionally, a recent private project proposing dredging in the lower Snohomish River found Nickel concentrations ranging from 58 to 65 ppm in which all other PSDDA parameters (except lead for one sample slightly above SL) were below screening levels. 17

o Page II-161, Table II.10-6 - It is stated that under the Puget Sound Interim Criteria (PSIC) there must be one core per 4000 cubic yards and one analysis for each 12,000 cubic yards of material dredged. This is incorrect. The PSIC are silent regarding numbers of cores and analyses required. Instead it leaves the decision regarding numbers of samples and analysis to EPA and Ecology decision makers on an individual project case by case basis.

The City of Seattle in the Four-Mile Rock interim disposal site requires one core sample for each 4000 cubic yards.

The PSIC covers the Commencement Bay disposal site and the Port Gardner criteria, identical to the PSIC criteria, covers the Port Gardner disposal site. Generally for the Commencement Bay and Port Gardner disposal sites, the number of core samples collected and analyzed is substantially lower than assumed in this table. In real terms a reasonable assumption for these areas is that the number of cores and samples analyzed would be essentially the same as is proposed by PSDDA. Therefore table II. 10-6 on page II-160 should be revised as follows: 18

Number of Cores   Number of Analyses

metals, merit adjustment, especially outside of the central Sound. Further study is necessary before the current SL value (28 ppm) can be adjusted.

Response 18. Your comment is noted and the reference to the Puget Sound Interim Criteria (PSIC) in table II.10-6 will be deleted. However, in most dredging projects the requirement for one core per 4,000 cubic yards was applied and more often than not, compositing of more than four cores for analysis was not allowed.

The assumptions made in applying the PSIC was that, in the absence of the PSDDA plan, this criteria would only become more stringently applied over time. An example was the inclusion of the PSIC sampling guideline into the shoreline permit for the Four-Mile Rock disposal site. Local shoreline jurisdictions agreed that this was a reasonable assumption.

Response 19. Values in the referenced table (table II.10-9 of EPTA) were derived using the formula presented in the last sentence of the footnote (cost = log (number of cores) x \$6,500). The number of cores estimated for each area was obtained from table II.10-6. A spot check of the computations verified the presented values for program design/management. Costs for coordination of permitting requirements with regulatory agencies were not included (these are summarized elsewhere).

We acknowledge that total project administrative costs associated with sampling, testing, permitting, and other aspects of seeking approvals for a dredging project can be substantial, especially in areas where there are pollution sources and natural resource concerns. The cost analysis presented in the EPTA includes an allowance for design and management costs assocated with sampling and testing but does not include allowances for general coordination and administration that are part of the process for obtaining the various permits and approvals for a dredging project. The PSDDA evaluation procedures are only one of a number of many factors affecting these costs. Accordingly, as comparable treatment of the study alternatives was our objective, only "representative" costs were estimated. Including additional administrative costs would only serve to confirm the selected alternative. Since there is no impact on the selected alternative we see no reason to refine the cost estimates.

Response 20. We agree that revisions to the cost assumptions would change the cost estimates. Collective best judgement was used at the time of the cost analysis. At this time any assumptions regarding the split in confined disposal technologies (options) is purely speculative. The experience with the Navy RADCAD project will be a factor as to whether or not CAD will receive wide public acceptance in the future. Upland and nearshore options are also very limited and have not gained wide public acceptance either.

The primary objective of the cost analysis was to allow comparable treatment of the study alternatives. It was not intended that all costs be presented that might be associated with a particular project. Administrative costs can vary a great deal, depending on the complexity of the project relative to

Port Gardner	959	240
Commencement Bay	613	140

(18)

The effect of these changes is the lowering of the estimated total PSDDA sediment analysis costs and result that testing costs are more expensive under PSDDA than PSIC.

o Page II-166, Table II.10-9 - Using the formula in footnote (a), the values for program design/mgt appear to be miscalculated and are substantially underestimated. For example we calculated the values for Port Gardner, based on the four projects and number of cores identified in table II.10-6, to be 58.2 rather than 19 as reported in the table. (19)

This table should be revised to incorporate the changes resulting from the previous comment regarding numbers of cores and analyses in the Port Gardner and Commencement Bay areas.

o Page II-170 - The assumption is made that 40 percent of the material not suitable for unconfined disposal will be disposed by open-water capped technologies (CAD) and only 19 percent by nearshore technologies. Revisions to these estimates may be appropriate. There are very few locations available for CAD.

The effect of not being able to find suitable CAD sites is to greatly increase the overall cost projections both for the interim criteria and the proposed PSDDA criteria. Table II.10-9 on page II-194 should be changed to reflect the more appropriate higher cost estimates. (20)

o Page II-179, Table II.10-14 - The assumption of $5000 for design and $5000 for permitting is highly unrealistic. Because of the difficulty in siting CAD sites, these prices could easily increase ten fold. A recent cost estimate for developing a relatively small nearshore disposal site (previously identified as a potentially suitable site by the Corps) amounted to $1.8 Million dollars.

o Page II-211 - It is indicated that procedural changes in the PSDDA program should be logical, allowing the managed system to adjust over time. We agree. Changes should not be made retroactive unless of a critical or extremely harmful impact is projected. The economic impact associated with reversing of permit decisions is potentially extreme and should be avoided. (21)

o Page II-212 - Several items for future study are identified. Many of these are very important and we (22)

support research on them. In particular the following are of obvious special significance to the Ports: (22)

1. Reducing the list of chemicals of concern which must be tested.

2. Reducing the number and intensity of potential bioassays.

3. Expanding the sediment quality values data base with the yearly data collected from dredging projects as well as other pertinent data base sets.

4. Investigation of the "Kriging" technique may have potential for reducing sediment collection costs. Apparently this procedure requires collection of less samples but nonetheless provides equivalent data. This procedure should be used on an early project and compared with standard collection procedures to see how well it works.

5. Development of confined disposal guidelines is absolutely necessary. As projected, substantial quan[illegible] of material will have to be confined. The dredger nee[illegible] design data on which to base decisions as w[illegible] in knowing that the disposal pr[illegible]cedures are proper (eg. rules and regulations will remain constant once the disposal decision has been made).

6. Reviewing the sediment quality values for possible adjustments and conduct efficiency analyses is very important. If statistical relationship between chemicals can be made (eg. always found together) there is potential that a surrogate chemical or chemicals can be tested yet be representative of the entire population of chemicals.

7. Cost saving procedures should be researched for small projects. The cost per cubic yard for permitting, sample collection and analysis for these projects is significant. In light of the small volumes, effort should be made to make the PSDDA "safety net" requirements less restrictive. (22)

Planning for study of each of these items should be undertaken quickly so that the opportunity of utilizing ongoing dredging projects as case studies can be undertaken. When this does occur, the extra costs above and beyond necessary testing requirements, should be funded by the appropriate PSDDA agency(s) rather than the dredger.

- Appendix B-7 - It is indicated that the main problem with the intrinsic rate of population growth (IRPG) test is the lack of local species that can be used. What would be the affect of using non local species? Would the test become invalid or difficult to interpret *if this were* done? 23

- Appendix D-14 - The example is given that since the chemistry analyses for several samples were below the SL levels, biological analyses would not be required. Because of the short holding times for sediments for biological analyses, this is probably not an accurate assumption. The likely result is that either the biological analyses would be performed on all samples with the idea of saving time or remobilization would be required to collect more cores for the biological analyses. Essentially costs are the same as for the initial testing. The Port of Tacoma is finding costs to run in the range of $1.00 per cubic yard for sampling, analysis, interpretation, and presentation of documentation. This estimate does not include Port staff time costs, actual dredging or disposal. 24

potential resource and human use impacts. Any assignment of administrative costs, incurred in the process of obtaining permits, to testing is arbitrary. We expect the PSDDA procedures to lessen the processing time as the same definitive guidelines will be used by all the regulating agencies. Increasing the cost allowance for confined disposal will not alter the study conclusions and the selection of SC-II for disposal site management. The volume of material required to utilize confined disposal remains as the key factor in distinguishing the site management condition alternatives. On an individual project basis costs associated with the alternatives to unconfined, open-water disposal bear on the "practicability" test under Section 404(b)(1) guidelines. No changes have been made to the cost analysis for the reason given in response 19. However, the text of the MPR and FEIS have been expanded in recognition of the port's views that cost differences between site conditions may be much greater than shown.

Response 21. Comment noted. Changes to the program must recognize previous decisions that are in process of implementation.

Response 22. The items listed in the comment (1-7) are all worth additional study and/or periodic review. Reductions (or increases) in necessary testing requirements will be assessed during the annual reviews. Expansion of the sediment quality data base will be accomplished by the PSDDA agencies as outlined in the MPR and final MPTA. Development of confined disposal guidelines is underway by Ecology. Pursuant to the 1987 Puget Sound Water Quality Management Plan, Ecology has initiated studies to establish confined disposal standards for contaminated sediments disposal in water (capped), along shorelines, and on land. These standards are expected to be available by late 1989. This summer Ecology will initiate a study on the feasibility of establishing a public, multiuser site for the confined disposal of contaminated sediments. A recommendation from this study is due by mid-1990.

Additional refinement of sampling guidelines and requirements for very small projects will occur as the agencies (and/or the dredging community) are able to allocate resources to conduct the necessary studies.

Response 23. There is no insurmountable barrier posed by the use of nonlocal species for regulatory testing. In fact, PSDDA is conducting chronic bioassay demonstration studies during *Phase II* using species from the east coast and California. The primary considerations involve: cost of importing the test animals (on a routine, regulatory basis), ability of the animal to survive in local testing *facilities*, and cost of establishing suitable testing facilities for long-term biological tests (ability to hold and maintain the animal). Beyond these matters of practicability, use of species not found in the Sound *are one step* further removed in their "surrogacy" for the disposal site fauna. Assuming that ongoing demonstation work proves successful, such a test may be available for use in the near future.

Response 24. Local laboratories can normally achieve turnaround in less than the recommended maximum 6-week holding time for bioassay sediments. When this is not possible, longer holding times may be permitted and dredgers should seek this option from regulatory agencies (see EPTA section II-4.5.2). PSDDA

MANAGEMENT PLAN TECHNICAL APPENDIX

o Page II-10 - The Ports support the issuance of a regional permit for dredging. In particular the permit could be of great value for maintenance dredging projects in which the environmental impacts would be expected to be low. For these projects, the adverse impact if any would likely be associated with contaminated sediments. Regional permit requirements to comply with PSDDA standards would overcome this problem. 25

The benefit to the Ports of the regional permit is that much of the time and expense associated with getting individual permits for each of these projects can be minimized. Equivalent environmental protection but at lesser cost could be realized.

o Page II-49, Data Management - The Ports support efforts to maintain a good data management system and would like to work closely with the agencies in the development and implementation of the system. We believe the following as a minimum should be tracked in the Corps computer system:

1. Sediment physical, biological and chemistry testing results data from all dredging projects.

2. Costs associated with the securing of permits for each individual dredging project (ie. permit processing fees, staff time (both agency and applicant), consultant time, special study costs, etc). 26

3. Time required for each of the component steps through completion of dredging (ie. securing permits, contract negotiation for actual dredging, fishery window constraints, actual dredging length, etc.).

4. Results from the baseline and ongoing disposal site monitoring studies.

Using this information, the yearly PSDDA reviews will have an excellent data base on which to make reasoned judgements. It is important that these yearly meetings assess the program management of the entire dredging and disposal operations as well as the chemistry and biological data. As new information is learned, it may be appropriate to modify regulatory procedures to gain more efficiency and cost effectiveness.

o Page II-57, 7.2.4.a. - It is indicated that Ecology proposes to adopt, through regulation or as agency guidelines, the PSDDA dredged material evaluation procedures as a basis for Section 401 water quality certification determinations. This should be done very carefully. We do not believe that the PSSDA "standards" and procedures should 27

agencies are further addressing this concern during phase II studies to seek ways of ensuring that the tiered approach is in fact operationally possible. Good advance planning and coordination by the dredger is necessary along with reasonable turnaround evaluation of chemistry data by the regulatory agencies. We are assessing ways of providing this service.

Response 25. Comment noted. Consideration of the regional permit is a separate action from PSDDA.

Response 26. Partially concur. The costs of dredged material sampling and analysis will be included in the PSDDA data management system. The results from the baseline and ongoing disposal site monitoring studies will also be included in the system. Dredger administrative costs associated with the securing of permits are highly variable and depend on the accounting system employed by the dredger. While important, we do not accept that the PSDDA data management system should be tasked to record these costs which are influenced by many factors other than PSDDA evaluation procedures. The ports are encouraged to participate in the annual reviews of data generated from the PSDDA plan.

be adopted as state water quality standards at this time. They should be retained as criteria in recognition of the fact that they are state-of-the-art and that changes to the evaluation procedures will likely occur in the next few years as new information becomes available. We suggest that Ecology include provision in its adoption that as changes to PSDDA are agreed to in the yearly meetings, the Ecology standards will be automatically revised to reflect the agreed to changes. Imposition of additional time delay will result in severe unnecessary financial impact on dredging projects. 27

o Page II-58, 7.4. - All work meetings should be noticed and be open to all potentially interested or affected parties. Additionally, an approximate date should be specified in the final EIS for the first annual meeting. Late May of 1989 may be a good date, since the first surveys of the site would have just been completed in April. 28

o Page E-2, 3.C. - The Ports encourage Ecology to support issuance of longer term disposal site permits. There would be great time and costs savings associated with not having to reissue the Shoreline permits once every five years. Also, provided the sites are complying with the PSDDA site condition standards, it is likely that there would be no environmental benefit associated with reissuance of these permits. 29

DRAFT MANAGEMENT PLAN FOR UNCONFINED
OPEN-WATER
DISPOSAL OF DREDGED MATERIAL

o Page 9-7 - The Ports would like to be actively involved during the DNR fee adoption process and periodic adjustments to those fees. It is important that every effort be made to manage the PSDDA program as efficiently as possible to keep disposal fees at a minimum. 30

Response 27. The concern regarding adoption of the PSDDA standards via State regulation is noted. This concern will be addressed by Ecology during the development and public review process of State regulation adoption which is currently under development.

Response 26. We agree. Adequate notice will be given prior to working sessions conducted as part of the annual PSDDA data and plan process. Given that 4 to 5 months will be required (following annual spring monitoring) for data generation and report preparation, we now anticipate that the initial review can begin by December of 1989 for the Phase I area with the first review meeting held in January 1990. This has been reflected in the MPR. The subsequent regulatory response, i.e., changes in monitoring, site use and dredged material evaluation procedures will depend on the results of the annual review and the process in place at that time.

Response 29. The model shoreline plan in MPTA provides for issuing permits beyond 5 years. However, 5 years is the current maximum permit period. DNR will seek greater periods in the future, following successful operating experience under the PSDDA management plan.

Response 30. DNR intends to involve the ports in disposal site fee adjustments. In April 1988, DNR mailed a formal notice of fee adjustment to Puget Sound ports suggested by the Washington Public Ports Association, including Tacoma and Everett. DNR is limited to setting fees no higher than necessary to cover program costs and will make every effort to keep costs to a minimum.

PSDDA PILOT STUDY

The purpose for a pilot study is to potentially save the dredger money associated with sediment testing protocols but at the same time provide adequate information for characterization of the sediments. Two ways of accomplishing this are:

A. Lowering the level of concern for the entire area or portions of the area to be dredged.

B. Reducing or eliminating chemicals of concern from testing requirements based on previous testing data.

Following is a proposed pilot study approach which utilizes chemistry analyses only to rerank the area in question and to eliminate additional testing for selected chemical parameters.

Step 1

Determine the initial rank of the area. (Note: Existing information may be good for part of the area and poor for the rest. The dredger may choose if he wishes to do a pilot study on selected sub-portions or all of the area to be dredged.)

Step 2

Determine the quantity of material in the top four feet of dredging and the subsurface material below the top four feet.

Step 3

For areas chosen by dredger to be tested in the pilot study, use Table II.4-2., page II-49 of the PSDDA EPTA to identify the numbers of cores required. (Note: The numbers of core samples remains unchanged from the full sampling requirements in the PSDDA protocols.)

Step 4

Undertake sampling procedures using PSDDA protocols (ie. sampling to depth of dredging and in 4 foot lifts), if possible. If done according to protocol there is strong possibility that some or all of the samples can be used in the final decision regarding the suitability of this material for unconfined open water disposal. (Note: The ability to collect these samples inexpensively will be the major factor

in being able to follow PSDDA protocols. If it is found that it is too expensive to collect cores to the depth of dredging, use of grabs or short cores may be appropriate.)

Step 5

Composite the core samples for laboratory analysis according to the quantities of material identified for the specified area of concern as identified in Table A. Undertake laboratory testing for chemistry using all PSDDA testing protocols.

TABLE A - Pilot Study sample composites

RANKING	SURFACE (CY X 1000)	SUBSURFACE (CY X 1000)
Low	48	72
Low-Moderate	48	72
Moderate	32	48
High	24	36

Step 6

For each individual chemical composite analysis results, use Table B to determine the revised rank of the area represented by that analysis.

TABLE B Revised ranking determination

CHEMISTRY RESULTS	REVISED AREA RANK
All parameters <SL	Low
One or more parameters >SL and <(SL+ML)/2	Low-moderate
One or more parameters >(SL+ML)/2 and <ML	Moderate
Any individual parameter >ML	High

Step 7

Based on the results rerank the individual areas represented by the chemical analyses of the composite samples. (Note: Some areas such as the subsurface sediments or sediments at distance from a contamination source may be ranked low yet the surface sediments near the contamination source ranked high.)

ATTACHMENT B

Pilot Study for PSDDA

Step 8

For each area represented by an individual composite analysis determine which chemicals need to be tested for further and which chemicals need not be tested further in that area as follows.

- o Analyze for all parameters found >SL.
- o Eliminate all organic parameters in which the chemical was not detected.
- o Using Table B, determine whether the revised area rank is higher or lower.
  - If the rank is lower, eliminate all parameters found below the SL.
  - If the rank is higher or remains the same as the initial ranking determine the difference in dilution factors due to compositing (see table C). Multiply each parameter result by this factor and eliminate all parameters from further testing which are calculated to be below the SL.

Table C - Dilution factor differences

INITIAL RANKING	REVISED RANKING	TOP DILUTION FACTOR	BOTTOM DILUTION FACTOR
Low-moderate	Low-moderate	1.5	1.5
Low-moderate	Moderate	3	3
Low-moderate	High	12	6
Moderate	Moderate	2	2
Moderate	High	8	4
High	High	6	3

Step 9

Using results from the above steps, devise the final sampling plan which includes bioassays. Provided PSDDA sampling protocols were properly followed (ie. 4 foot core sections, etc.) individual cores and sampling analyses undertaken in the pilot study may also be used as data points for the final determination regarding suitability of the material for unconfined open-water disposal.

(Note: The dredger in some cases may wish to undertake biological testing concurrently with the chemistry analyses during the pilot study. Provided the chemistry and biological results are favorable and PSDDA protocols are followed, it may be possible to avoid collection of additional samples. For example, if the area was originally ranked as high but the pilot study testing indicated low concern, then the number of samples and testing would be more than adequate for making decisions regarding unconfined open-water disposal. Of course, if the pilot study testing indicates a higher rank or the same rank of the area, additional testing would be required.)

Seattle
Department of Construction and Land Use

March 7, 1988

Re: DEIS-Proposed Cpen-water Disposal Sites

Frank Urabeck, Director
Puget Sound Dredge and Disposal Analysis
U.S. Army Corps of Engineers
Seattle District
P.O. Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Urabeck: Frank

The Department of Construction and Land Use (DCLU) has reviewed the Draft Environmental Impact Statement. Your effort in preparing this extensive documentation is to be commended. The major agencies involved in the PSDDA process can be justifiably proud of this work. DCLU is currently reviewing an application for shoreline permits for the Elliott Bay site. Analysis and decision on that application will be completed after this EIS is finalized. Our comments on the Draft EIS follow.

<u>Site Condition</u>: The PSDDA recommended Site Condition II (minor adverse effect) appears to be a reasonable short-term goal for disposal sites. However, given the City's commitment to the long-term protection of the environment, we would prefer that through time, as experience results in reevaluation and clarification of the PSDDA process, Site Condition I (no adverse effects) would become the goal. 1

<u>Site Monitoring</u>: The environmental "health" of the disposal site is an important consideration. The proposed plan does not include ongoing monitoring at the Elliott Bay site. The long-term effects would be very difficult, if not impossible, to evaluate without careful monitoring in and around the site area. Monitoring of the Elliott Bay site should be a part of the proposed site management program. 2

<u>Evaluation Procedures</u>: The general approach of the proposed evaluation procedures appears to be reasonable. As we review the shoreline permit application we intend to examine more 3

RESPONSES TO SEATTLE DCLU 7 MARCH 1988 LETTER

<u>Response 1</u>. The position of the city of Seattle regarding the long-term site condition for the proposed disposal site is acknowledged. Please see responses No. 1, 3 and 9 to the NMFS letter.

<u>Response 2</u>. We agree. Biological stations have been added to the baseline monitoring program for Elliott Bay. These will be continued if data collected during the May 1988 baseline effort support their use for subsequent environmental monitoring (see response No. 4 to the PSWQA letter). See the Management Plan Technical Appendix (MPTA) exhibit I for the specifics of the Elliott Bay monitoring plan.

<u>Response 3</u>. Your comments are acknowledged. Please see responses No. 6 to the Suquamish Tribe letter, No. 1 to the PSWQA letter, and No. 2 to the WDF letter.

thoroughly the adequacy of the actual values proposed. At this time, our comment is limited to objecting to allowing materials which exceed maximum levels under some certain circumstances. If the identification of a "maximum" level is to be meaningful in trusting that the long-term process will not result in unexpected adverse impacts, materials exceeding "maximum" levels should be categorically unacceptable for disposal at the PSDDA site. Further, materials which have values exceeding maximum levels should certainly not be allowed at some other, applicant selected, open water location. It would be unrealistic to expect that shoreline permits could be granted for disposal at other than the PSDDA site, especially for materials more contaminated than those allowed at the PSDDA site. 3

Another area of concern relates to the role of "professional judgment" in evaluating the results of biological testing. While it is reasonable to anticipate that the state of the art for evaluating the effects of various concentrations will change through time, case-by-case review doesn't give the certainty that a set of established limits would. Elaboration, especially related to how the range of individual judgments would be limited and how modifications of the levels would be made, should be included in the EIS. 4

Site Selection: The process used for site selection reflects sound methodology. We are, however, concerned about the evaluation of two concerns included in the selection of the preferred Elliott Bay site. First, some clarification regarding the character and abundance of shrimp is needed. It appears that shrimp in area of the preferred site could be characterized as being near levels which could be commercially harvested. A clearer explanation of why the loss of this resource would not be considered to be significant is warranted. 5

The other concern is potential conflicts with shipping traffic. The Duwamish East and West Waterways are very important for Seattle's marine commerce. The EIS needs to indicate the nature and amount of ship traffic which would be passing the preferred site and at what distance. This information would allow independent evaluation of potential impacts given the frequency of barge trips to the site and the duration of the disposal operation there.. 6

Thank you for this opportunity to comment. If you have any questions, you can contact me at 684-8875.

Sincerely,

HOLLY MILLER
Director

By Meredith
MEREDITH A. GETCHES
Senior Land Use Specialist

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Response 4. As discussed in sections 5.5.10 and A.10 of the Management Plan Report (MPR) and sections I-2.4 and I-2.5 of Evaluation Procedures Technical Appendix (EPTA), PSDDA was intended to provide both consistency and flexibility in the application of dredged material evaluation procedures. However, any departure from the PSDDA guidelines will also require that the regulatory agencies document the rationale for this departure. Also, this process is subject to public review (see response No. 10 to the Puyallup Tribe letter).

We have expanded the discussion in the above referenced documents to more clearly reflect the process where collective professional judgment will usually be employed by the regulatory agencies in those instances where the guidelines are not followed precisely. The likelihood of arbitrary decision-making has been significantly reduced through the very detailed PSDDA dredged material evaluation procedures.

Response 5. Please see responses No. 9 to the NMFS letter, No. 7 to the Suquamish Tribe letter and No. 9 to the WDF letter.

Response 6. Shipping traffic in the vicinity of the site will consist of traffic using the East and West Waterways, the Duwamish Waterway, and Harbor Island, and the southerly portion of the Seattle Waterfront, i.e., terminals 37 through 46. Ferry traffic will also pass north of the site. While the site is located partially within the harbors' southeast, Coast Guard designated anchorage area there is no restriction to vessels moving through the area in terms of the designated anchorage nor are there traffic lanes. An indication of the amount of traffic generated by the Duwamish Waterway is the number of Spokane Bridge openings. In 1987 there were 5,380 openings with the monthly traffic varying from 330 in February to 588 in July. The Port of Seattle estimates that in 1987 their facilities on the West Waterway were called on by 836 ships. Some of this traffic to and from the East Waterway did pass near the western edge of the preferred disposal site.

Disposal site use and other vessel traffic will be monitored by the Coast Guard via their vessel traffic system. Shipping interests, e.g., pilots, towing companies, are advised well in advance of proposed site use via the Coast Guard mariner notices. Also dredgers must notify the vessel traffic system of estimated time of arrival at the site of each barge. The Coast Guard will help position barges to ensure that dumping occurs in the disposal zone. While a potential for conflict exists, proper use of normal marine navigation procedures and the Coast Guard vessel traffic system should minimize this risk. Also, as you are aware, we have shifted the disposal zone about 375 feet to the south-southwest. This will further reduce the risk of vessel conflicts (see MPR chapter 4).

PORT of TACOMA U.S.A.

March 11, 1988

Mr. Frank J. Urabeck, Study Director
Puget Sound Dredged Disposal Analysis
Planning Section
U.S. Army Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Dear Mr. Urabeck:

The Port of Tacoma appreciates the opportunity to comment on the PSSDA Draft Environmental Impact Statement and the proposed Draft Management Plan. We compliment the participating agencies on the tremendous amount of "groundbreaking" work accomplished over the past three years, particularly the Corps of Engineers, whose leadership has been vital in developing this proposed program.

The Port of Tacoma finds the draft EIS to be a very comprehensive evaluation of the program, the proposed sites, potential impacts, and the alternatives. The document is highly informative and will be a great aid to the public involvement and decision-making process which it is designed to serve.

We want to stress our support for PSSDA's efforts to establish environmentally safe, cost effective, publicly acceptable standards for deepwater disposal. In general, the Port of Tacoma supports the recommended process and the conclusions of the PSSDA study. During the PSSDA process, strong attempts were made to balance environmental concerns with economic realities. However, in areas where hard data does not now exist, the Port believes that PSSDA took the position most protective of the environment. Other concerns include the stringency of standards, testing and evaluation procedures, disposal site availability, and permitting.

Both general and specific comments to these issues follow. In addition, we have included a separate document addressing specific items in the DEIS, the Proposed Management Program, and the technical appendices. The latter is a joint effort of the Port of Everett and the Port of Tacoma.

Need for Dredging

To give context to the Port's concerns, below we reiterate the Port's responsibilities and the need for dredging.

The Port's mission is mandated by state legislation to promote economic development programs through port development (RCW 53.08.245). Trade through public ports is a critical component of the economy and is of national, state and local significance. Estimates are that one in five jobs in Washington state are trade related. Tacoma is now the 6th largest port in the country, and the 20th largest port in the world, with attendant benefits to employment and the economy of Pierce County.

To maintain this position, to operate and to grow, it is mandatory that the Port be able to dredge. Maintenance dredging is a basic need in river estuaries where ports are located. An estimated 370,000 CY of sediment is discharged from the Puyallup River each year...some of which ends up in the Port's most active waterways. Maintenance dredging is required to retain existing berthing areas and navigation channels.

This past year, in two situations, sediment accumulation threatened berthing and approach areas for container ships...ships were in danger of running aground a shoal during ship approach, or resting on high spots in berthing areas during low tide. Since new ships can cost upward of $60 million, potential ship damages are one obvious downside to restrictions on maintenance dredging. 1

Dredging is also needed to accommodate the larger ships now coming on line. Major changes are occurring in the shipping industry and are placing entirely new demands on Port terminals. Because of containerization, the shift to intermodal railcar transportation, and decisions by shipping companies to build 'post panamax' ships, ports now must dredge waterways and berthing areas to accommodate ships to 950' in length and larger. The 35' deep waterway is being replaced by the 40' to 45' deep waterway. Finally, to respond to new Pacific Rim trade opportunities, the Port must dredge to construct new terminals and waterways.

Permitting and Dredge Disposal Issues

Timely permits for dredging and disposal are critical to the Port. Uncertainty and costs of permitting are major problems facing the Port, particularly with maintenance dredging that is difficult to predict. Currently we spend six to nine months 2
applying for permits with considerable uncertainty as to where we

Mr. Frank J. Urabeck
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can place dredge material. In contrast to the time needed to secure permits, actual dredging and disposal can be accomplished in a matter of weeks. We have experienced a many fold cost increase with dredging and disposal. Part of this cost increase is attributable to the increased complexity of the permit review process. Other costs relate to increased sampling and monitoring programs and are discussed below. (2)

The PSSDA Program will benefit the Port because it helps address some of these uncertainties and proposes follow-up to ensure Puget Sound is protected. PSSDA recommends sites and comprehensive dredge material standards with follow-up site monitoring. Hopefully, dredge standards and criteria will be accepted by the community, and dredging within these parameters will be viewed as routine. (3)

Dredge Disposal Sites

The Port must have feasible places to dispose of dredge material. Feasible for the Port means disposal must be environmentally sound, must be economically viable, and that sites be available. As you are aware, the Shoreline Permit for the existing Commencement Bay Disposal Site expires June of 1988, and approval of new sites is dependent on state and local Shoreline Permit decisions. (4)

The Port of Tacoma supports the designation of the Commencement Bay disposal site, and believes the process and criteria for identifying the sites were exhaustive and environmentally sound. Site availability is absolutely essential to the Port to accommodate both maintenance and development related dredging projects.

Dredge Material Standards and Evaluation Procedures

PSSDA disposal guidelines are the most stringent in the country. PSSDA estimates roughly 60% of material will qualify for deepwater disposal in contrast to the 90% qualifying nationally. Based on recent projects completed in accord with PSSDA, we believe costs will be higher than projected for open water disposal and that less material than projected will qualify. Further, the evaluation procedures add significantly to the time for securing project approvals. (5)

We suspect that the DEIS may underestimate economic impacts to ports and marine industries, and have concerns that cost estimates may not reflect real world situations. One concern is that proposed costs of dredging may not account for the added costs and complications of physically dredging and disposing of (6)

RESPONSES TO PORT OF TACOMA 11 MARCH 1988 LETTER

Response 1. Need for dredging acknowledged.

Response 2. The recent increase in the cost and complexity associated with dredging and disposal of dredged material can generally be attributed to additional sampling and analysis requirements. With the implementation of PSDDA it is expected that these costs will again be increased, as will fees for using the PSDDA disposal sites. However, the permitting process should be less complex as there should be less uncertainty with dredged material evaluation once the PSDDA guidelines have been applied and dredgers become knowledgeable in their application.

Permit applicants should provide adequate lead time in project planning for sampling and analysis as well as processing time for shoreline permits and hyraulic project approvals. It has been our experience that project delays have occurred when an applicant has not considered effects on habitat at the dredge site or has begun the process unaware of the sampling and analysis requirements. PSDDA will help standardize the procedures for sampling and analysis but does not address the other permits often associated with dredging projects.

Response 3. Comment noted.

Response 4. Comment noted.

Response 5. The majority of material dredged nationally is sand, which has very low capability for accumulation of chemical contaminants. In the central basin of Puget Sound, sand represents a very minor component of the dredged material matrix. The majority of the dredged material is a mixture of fine sands with a major percentage of silts and clays. Chemical contaminants have a much greater affinity for these fine-grained sediments. Actual testing of sediments is necessary to determine how much material would be acceptable for unconfined, open-water disposal. However, we believe the 60 percent estimate is reasonable for material that would be found acceptable for unconfined, open-water disposal. While PSDDA tests and disposal guidelines are viewed by some as the most restrictive in the Nation we recognize that the region has established water and sediment quality goals that are even more restrictive.

When adjusted for price level changes we anticipate that the average costs of the PSDDA tests will be reasonably close to the estimates used in our alternatives comparison. The amount of time required for sampling and testing is not expected to differ greatly than now required in response to the Puget Sound Interim Criteria (PSIC). We will be assessing cost impacts of PSDDA as part of the first annual review (winter of 1989).

Response 6. The cost estimates were based on best available information and experience of agency regulators and dredgers. It is impossible to account for

material where unacceptable layers of contaminated material are interspersed with acceptable material. And, if cutoff points are too restrictive, a greater proportion of material will need to be disposed of using more expensive disposal options. Other specific comments are included in the appended document.

Nevertheless, we are willing to accept the proposed chemical and biological standards and procedures if we can be assured the need for such stringency will be reconsidered as data is gathered. We support the preferred alternative (Guideline II) or a less stringent alternative for disposal guidelines. The preferred alternative allows for minor adverse on-site biological impacts--more stringent requirements (such as the interim criteria) are simply not realistic. 7

The Port believes the public has developed the opinion that all dredge material is a hazardous waste. This is simply not true and in fact dredge material from active navigation channels will improve in future years. For example, as the port and other responsible parties complete the necessary Superfund cleanup, material to be dredged will be much cleaner. Also, testing focuses on the worst case portion of material. Most of any particular dredge unit is much cleaner than screening levels. 8

Another issue is that the biological evaluation procedures are, as yet untested. We are uneasy about their use as a regulatory tool. Although bioassays are probably the best tools available, tests are still quite primitive and should be used only as an indicator. Instead they are relied upon as a major determinant of impacts to marine life and the broader environment. We believe that PSSDA evaluation procedures and standards for both chemical and biological parameters should remain as "criteria". They should not become state standards until methodology, protocol and standards are thoroughly evaluated. 9

PSSDA Implementation

The PSSDA management plan is very thorough with respect to how agency responsibilities must be carried out. However, the plan should clearly establish a role for affected parties during PSSDA implementation. As now proposed, Port involvement in future evaluation is discretionary. 10

Further, reevaluation of procedures and standard needs to occur on a regular basis...not solely when determined by agencies. Again, review by affected parties must be built into this reevaluation process. As an example, we refer to the process the Department of Ecology uses to review and revise water quality standards. This process involves extensive public notice and 11

every contingency when undertaking a programmatic study such as PSDDA. Fortunately, the management plan does provide for feedback and contains a mechanism for reassessment and adjustments if the data support this.

Response 7. We fully intend to reassess all elements of the management plan each year, based on data generated from implementation of the plan and new information from other areas where dredged material disposal is being managed.

Response 8. We share your belief that dredged material quality should improve in the future as point source standards are tightened and nonpoint source controls are implemented. There is evidence already that conditions have improved in the last decade. PSDDA sampling and analysis guidelines are not a "worst case" approach as sample compositing is allowed which reduces chemical concentrations.

Response 9. See response No. 14 to Port of Everett attachment A. Your comment is noted regarding the need to gain further experience with these tests before the State includes them in State standards.

Response 10. Chapter 9 (paragraph 9.4 Plan Updates) of the Management Plan Report (MPR) has been expanded to clarify our intent to involve all interested parties in the update of the plan. A new paragraph, 9.2.6 Other Interested Parties, has been added to address this concern. All interested parties are encouraged to participate in ongoing PSDDA technical meetings. Feedback on PSDDA evaluation procedures would be particularly appreciated during the initial implementatation of PSDDA.

Response 11. See revised chapter 9.4 for our commitment to annual reviews and involvement of all interested parties, particularly those who are being regulated. We have not yet established a formal process for conducting the annual review and plan updates. Your suggestion for an advisory committee will be considered.

involvement in review on revisions of study. An advisory committee similar to the Solid Waste Activity Council (SWAC) developed to evaluate solid and hazardous waste concerns. The Port would want to be an active participant. EPA's process and criteria for setting drinking water standards is another model. 11

The Port also sees a critical need for a data management system and a process to insure periodic review of data. This review must evaluate adequacy of protection, track costs of all dredge disposal projects, evaluate agency and applicant time to complete permitting and provide a chance to legitimately reduce standards where justified. 12

Relationship of Proposed Program to Other Dredge Disposal Alternatives

PSSDA has resulted in a de facto determination of dredge disposal alternatives. At least 40% of material will go someplace else. This ultimately may be more important to the ports than the initial 60%. The Port needs agencies firm commitment, funding, and timely completion to insure other dredge disposal options are readily available and economically viable. Questions include where to put the material unsuitable for deepwater disposal and how responsible agencies will make decisions about the tradeoffs between upland, nearshore, confined, and open water disposal alternatives. Tradeoffs involve both environmental and economic considerations. 13

Although the above issues are to be the subject of the "Son of PSSDA" study, and consideration of multi-media impacts is voiced as a concern by EPA and Ecology, little has actually been done to resolve this problem. In contrast, we face the immediate problem that upland, nearshore and confined disposal are not readily available to accommodate the other 40% or more of dredged materials that do not qualify for unconfined open water disposal.

Interim reliance on existing hazardous waste sites is not a good resource decision because costs are astronomical and because such sites should be reserved for hazardous waste. Although Ecology has indicated a commitment to developing a multi user upland site, the process and controversy of locating such a site is similar to those with locating a hazardous waste site. We believe the multi user site could not be available before 1992. 14

Permit approvals for siting nearshore or confined aquatic sites will be another major hurdle, and may be beyond the capabilities of any single dredger to secure. Reasons include the costs of developing such sites, the complexity of testing and monitoring, and the uncertainty of the permitting process.

Response 12. By data collection plan has been expanded to include sediment sampling and analysis costs. Since overall dredging projects costs are dependent on many factors other than PSDDA, other costs will not be included in the PSDDA data collection and management system. Cost data from permitees will be requested when sediment test data are furnished to the Corps for Section 404 permit evaluations. We are uncertain at this time of how the volume of dredged material disposed at other than the PSDDA sites will be obtained, if that disposal is not governed by a Section 404 permit. We intend to discuss this further with the ports.

Response 13. Noted. Ecology has recently initiated a study that will address confined disposal issues. See response No. 14 below and response No. 2 to Attachment A to Port of Everett March 11, 1988 letter.

Response 14. Guidelines are now being developed by Ecology for dealing with contaminated sediments, pursuant to the 1987 Puget Sound Water Quality Management Plan. Ecology has initiated studies to establish confined disposal guidelines for contaminated sediments disposal in water (capped), along shorelines and on land. These guidelines are expected to be available by late 1989. Also, this summer Ecology will initiate a study on the feasibility of establishing public, multi-user sites for the confined disposal of contaminated sediments. A recommendation on disposal sites is due by mid 1990.

We assessed the economic consequences of dealing with contaminated dredged material, on a generic basis, in the evaluation of the site condition alternatives (*see FEIS sections 2.04.a and 4.01, and MPR section 5.4*).

Mr. Frank J. Urabeck
March 11, 1988

Although resolution of these issues and questions is beyond the scope of the PSSDA study, these issues should be made clear to the public when presenting PSSDA. If the decision is presented to the public solely as a choice between deepwater disposal sites and the acceptability of varying levels of sediment contamination in Puget Sound--the tendency may be to choose the more restrictive option. Future studies and programs (e.g., the "Son of PSSDA") must also consider and convey these broader issues. A limited focus on any one disposal option neglects the broader issue of multi-media concerns and the real tradeoffs between dredged material disposal alternatives. 15

We believe dredge disposal is a broad public issue and that the inability to dredge and dispose can seriously impact the broader public interest. Disposal issues must be viewed as more than the dredger's problem. Whereas agencies have necessarily focused on developing standards, they now need to help solve the corollary problem of where material can go. 16

We hope these comments are of value to you. Once again, we thank you for the opportunity to comment.

Sincerely,

Leslie Sacha

LESLIE SACHA
Environmental Affairs Manager

LAS:ijm

cc: John Terpstra
Paul Chilcote
Washington Public Ports Association
Dennis Gregoire, Port of Everett

Response 15. We agree. Your comments are well taken. During meetings with business associations, Indian Tribes, environmental groups, and others we have attempted to provide a balanced presentation of PSDDA. We have continually sought to have the other Federal and State agencies, tribes, local governments and the general public recognize the limited options that are available for disposal and the economic and social consequences of the choices that were considered by PSDDA agencies.

Response 16. We agree.

RESPONSES TO PORT OF TACOMA ENCLOSURE TO 11 MARCH 1988 LETTER

See responses to Port of Everett attachment A (jointly prepared by Port of Tacoma and Port of Everett) of Port of Everett 11 March 1988 letter.

Port of Seattle

March 15, 1988

Mr. Frank J. Urabeck, Study Director
Puget Sound Dredge Disposal Analysis
Planning Branch
U. S. Army Corps of Engineers
P O Box C-3755
Seattle, Washington 98124

Dear Mr. Urabeck:

Re: Review of PSDDA Draft Environmental Impact Statement

Subject to the specific concerns noted below, the Port of Seattle finds the "Draft Environmental Impact Statement Phase I" to be a reasonable summation of the extensive efforts of the PSDDA group over the past 3 1/2 years. Furthermore, the technical quality of the work, the broad based agency participation and cooperation, and the continuing efforts to seek out and be responsive to all points of view are to be commended.

With regard to the proposed open water disposal sites, we find the selection process to be thoroughly sound in all respects. In particular, we believe the preferred disposal site for Elliott Bay is an excellent choice because of the projected minimum resource impacts and the low dispersive nature of the site.

We have provided formal, specific comments on past drafts of the various technical appendices and other documents and have participated actively in many of the process deliberations from the beginning. We are pleased to note that the final draft EIS has taken into account several of our previously voiced concerns. However, we do want to reiterate some of our past concerns over key aspects of the proposed plan.

We find the proposed sediment evaluation procedures to represent a minimally acceptable first step compromise among the range of possibilities, but we continue to be concerned that they are unnecessarily restrictive and will be much more costly in application than projected in the Draft EIS. (1)

As we have pointed out during the continuing PSDDA deliberations, our principal problem with respect to the procedures is their strong reliance on and high costs associated with bioassays. This suite of bioassays has not been used in regulating dredged material. An item of particular concern is the relation of the laboratory toxicity measured by this suite of extremely sensitive organisms, to the toxic impact of those same sediments in place on the disposal site. Previous studies (Black Rock Harbor, etc.) indicate a reduced impact on site. (2)

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[illegible]

RESPONSES TO PORT OF SEATTLE 15 MARCH 1988 LETTER

Response 1. We feel that the evaluation procedures are appropriate at this time but agree that the procedures need to be periodically reviewed and adjustments made in light of operating experience that considers both environmental and economic impacts. See response No. 5 to the Port of Tacoma's letter and response No. 20 to attachment A of the Port of Everett's March 11, 1988 letter.

Response 2. The PSDDA evaluation procedures employ a tiered approach to testing that allows the dredger to discharge at a designated disposal site after having performed chemical tests of the dredged material (also the other requirements of permit process must be satisfied) if chemical concentrations are all below the SL values. While it is true that this suite of bioassays has not been required in the past, the PSDDA agencies are satisfied that sensitive organisms should be used to provide the environmental protection we, other Federal and State agencies, tribes, and the public feel is appropriate for Puget Sound. Because the "state-of-art" of sediment chemistry is rapidly evolving we will be reassessing our tests and disposal guidelines and looking for ways of eliminating what may be unnecessary requirements or substituting more effective and less costly tests. The ports are encouraged to participate in this process. We agree with your comment regarding Corps research findings that laboratory toxicity tests overstate toxic impacts that would be expected in the field. PSDDA guidelines for interpreting bioassay tests were established in consideration of the known relation between lab tests and field effects. (PSDDA agencies already considered the decreased effects in the field by adjusting the disposal guidelines.)

Microtox bioassay, though it may show promise for the future due to fast turnaround and low cost, is a bit premature even as a "corroborating test". Due to the technical problems, uncertainties, and significant increase in costs we continue to question that the level of proposed testing is necessary or warranted. (3)

We definitely and strongly support the proposed "dredger option."

With regard to costs, many of the cost estimates used in the Draft are significantly lower than those experienced by the Port in actual situations. For example, regarding the costs of sampling and testing, our independent survey of commercial labs shows that the biological testing costs of the tests shown in Table II.10.8 should be $4,600 rather than the $2,800 shown in the table. Furthermore, we continue to feel strongly that an inflation factor should be added to enable the marine industry to get a more accurate feel for the true level of the projected disposal fees. (4)

We also find the costs of the confined disposal options to be grossly under estimated. Many of the particular deficiencies we have raised earlier have not been corrected. It appears, in fact, that only simple mathematical errors were corrected. This has resulted in erroneous conclusions and incorrect cost estimates. Several continuing concerns are: (5)

- we do not agree that lessons learned from the Terminal 91 experience will enable future similar projects to be an order of magnitude lower. (6)

- the estimation of 40% of the material for CAD, is much too high for this technology in Puget Sound. There is a lack of suitable locations for CAD sites in most of Central Puget Sound including Elliott Bay. Specifically, the overdredged areas of the Lower Duwamish Waterways have been mentioned in the past as an appropriate area for CAD disposal. The Port is opposed to any further use of the overdredged portions of these waterways in this manner. These areas are berthing areas for the largest container ships, whose size and draft have been steadily increasing over the years. In the future we will need much more depth than the presently authorized channel. It would be very short sided to fill this overdredge with contaminated sediment which might have to be removed and disposed of at a later date. (7)

- the presumed location of upland sites is faulty, resulting in assumed haul costs which are underestimated by an order of magnitude. (8)

- nearshore disposal costs are based on old estimates for large hydraulic dredge fills, for which there are few suitable sites. Also, they do not reflect the reality of the smaller and/or clam shell/dump barge operations such as the T-91 shortfill. These are more common, and will account for much of the material. They will also cost more than an order of magnitude greater than the Draft's low estimates. (9)

- costs of monitoring, permitting and design are not included for a CAD site. (10)

Response 3. As we have only a few years of applied sediment experience with the microtox bioassay, we agree that it should not be used as the sole tool for disposal decisions. However, if another bioassay indicates statistically significant adverse effects, the microtox test is sufficiently developed to act in a "corroborative" or "confirmative" role.

Adjustments to the protocol and test interpretation are expected, perhaps sooner with the microtox than with the other proposed tests, as experience is gained. EPA's ongoing bioassay comparison study in Puget Sound may provide potential improvements during this year. It is also possible that a better benthic test will be identified during this study, allowing consideration of potentially replacing the extract tests (bivalve larvae and microtox). Any adjustments would be scheduled to occur during the annual reviews of the PSDDA program.

Use of multiple bioassay test species is necessary to ensure that different chemical sensitivities of different species are considered in disposal decisions. Recognizing the cost implications of this approach led, in part, to the use of chemical test results to decide when biological testing was necessary.

Response 4. PSDDA agencies recognize that costs of testing can vary between public and private laboratories as well as because of the size of the project, other workload, and the desired turnaround time. However, the cost data, shown in the PSDDA documents, was based on the best available information and reflects input from commercial testing laboratories. Recent contacts with both public and private laboratories tend to support the reasonableness of cost data. The primary objective of the PSDDA cost analysis was to identify "representative costs" that would allow a fair comparison of alternative site management conditions. Recent (1988) contracts for conducting PSDDA chemical and biological tests have shown current costs to be reasonably close to those shown in the PSDDA documents (1986 prices), when adjusted for price level changes.

The common practice of using the current (1986) price level was used in estimating future monitoring costs and related user fees. This allows each project planner to calculate a range of possible inflation scenarios. Additionally, each PSDDA alternative was treated with the same assumptions, ensuring an objective comparison.

Response 5. We acknowledge that other, equally valid cost assumptions could be used in the analysis. However, any increase in unit costs for confined disposal would not alter the conclusion regarding the preferred site management alternative but reinforce the selection of site condition II (SC-II). The differences in volume of material required to use confined disposal is the major factor affecting the cost differences among the alternatives.

Response 6. Comment noted.

Response 7. We agree that a lower percentage of material could be assumed for CAD disposal and that the lower Duwamish waterways are in appropriate sites for any large scale use of this disposal option. Reducing the percent volume for CAD would increase the cost of confined disposal and thereby further support the selection of SC-II. See response 5 above.

Response 8. Comment noted. Until the confined disposal study, now being initiated by Ecology, is completed, any assumptions regarding the mix of confined disposal options and the location of specific sites would be purely speculative. However, the assumptions made for the PSDDA cost analysis are considered by the PSDDA agencies to be reasonable based on information currently available. See response Nos. 4 and 5 above.

The Site Management Condition concept seems to be a good idea in principle, but we are concerned that the definition of classes allows for a high degree of subjectivity in its application. We also understand the desire for and arguments to justify consistency in classifying all sites. However, we believe that more attention and weight should have been given to the other side of the argument. In particular, we believe that Site Condition II is unnecessarily restrictive for the proposed Elliott Bay site. We are also concerned that the site classifications are not open to change in the future. 11

We understand and accept the need to begin with a conservative approach, but we trust that a process will be provided for continuing reassessment and revision, as appropriate. In this regard, our most serious reservations at this point are over the proposed implementation plan. 12

Our principal concern relates to Section 7.4, Plan Updates, of the Draft Technical Appendix. It does commit to a continuing process of re-evaluation of all aspects of the plan, and to making changes, as appropriate, and it emphasizes cost-effectiveness as a major decision criterion. But it doesn't say enough about how that will happen and who will make it happen. Given the importance of this updating process to the marine industry and those others who will be significantly impacted by this program, we feel strongly that the process must be spelled out in detail and implemented through a formal *administrative procedure*. At a minimum, the Draft should specify responsibilities and a schedule for development, approval and implementation of such a procedure. This should be similar in form to the work plan in Exhibit A of the Draft. 13

Closely related to the above, we are also concerned about Section 6, Data Management, and particularly, Section 6.5, Recommended Data Plan, and Table II.6-1, Data Management Elements. No explicit provision is made for costs. We assume a major purpose of the data system will be to serve as the principal *means for conducting the plan updates, i.e., evaluating the program. How can* cost effectiveness be evaluated without cost data? Section 7.4 notes that "...cost data will be provided by the Corps and the permittees." How is that expected to happen? Why isn't it noted in the Data Management Elements or the Data Plan? And how will all of the elements tie together? 14

In our view, this is a clear indication that very little thought has been devoted in the development of the data management program to the specific terms by which the overall program will be evaluated. The basic evaluative criterion, of course, must be the PSDDA program goal. The goal statement is very explicit about some of the factors which must be considered in evaluating the success or effectiveness of the program including technical soundness, practicability and costs. What questions will the plan updating process ask to address these factors? And how will the data system be designed to assure that the information necessary to answer them is collected, compiled and reported to the responsible decision makers? 15

<u>Response 9</u>. Comment noted. See response No. 4 above.

<u>Response 10</u>. Though some monitoring costs were assumed, added monitoring that may be required to address project-specific concerns in the nearshore environment was not included in the cost analysis. This was due to the high variation that could be expected for this type of monitoring. Regardless, the study conclusions would not be altered if a cost was added to address this concern. See response No. 4 above. Further clarification has been added to the text in EPTA to clarify our assumptions. Permitting and design were considered for the CAD design (see table II.10-14, EPTA), though monitoring was not. This was due in part to the more rigorous technology assumptions for this disposal technique (see section II-10.3.4.2 of EPTA), and in part to an assumption that the material was not sufficiently contaminated to warrant intensive monitoring. The text of EPTA has been revised to note the omission.

<u>Response 11</u>. Comment noted regarding restrictiveness of SC-II. We acknowledge that for much of the Elliott Bay site SC-II will result in an improvement of sediment quality. SC-II was selected as the regional management condition for all three of the Phase I disposal sites. See response No. 7 to NMFS letter regarding the regional approach taken by PSDDA. However, a change in site management condition is possible in the future but any change would require the same full public involvement process that was employed in the PSDDA study, including compliance with the National Evironmental Policy Act (NEPA). See FEIS Section 1.05.

<u>Response 12</u>. We agree. The Management Plan Report (MPR) Chapter 9 has been revised to more fully reflect our commitment to an annual review and updating process.

<u>Response 13</u>. The Management Plans Technical Appendix (MPTA) Section 7.4 and the MPR chapter 9 has been expanded to more clearly reflect the commitment of the PSDDA agencies to a review and updating process (see response No. 12 above). Also see response No. 28 to Attachment A of the Port of Everett March 11, 1988 letter.

<u>Response 14</u>. Comment noted. MPTA Section 6.5 has been revised to include dredged material sampling and analysis costs as data that will also be collected and analyzed under the PSDDA data management system. See response No. 26 to attachment A. Also we anticipate that other pertinent costs for such activities as dredging, disposal, monitoring, project management, etc., will be considered but obtained by special studies perhaps conducted jointly by the Corps and the ports. This is because the costs of these other activities are dependent on many factors other than PSDDA influences. Accordingly, the costs of these activities will not be included in the PSDDA data base. Cost data from permittees will be requested on a voluntary basis when sediment data is furnished to the Corps as part of Section 10 and Section 404 permit applications. Data from Corps dredging projects will automatically be entered into the data management system.

<u>Response 15</u>. The annual review and plan update process will be the means by which PSDDA agencies collectively reassess key plan elements in light of operating experience and new information provided by ongoing research or gained from dredged material disposal elsewhere. We agree that the PSDDA goal should be the basic evaluative criterion. See MPTA section 7.4 a list of questions that will be addressed as part of the annual review.

The data base system is being designed to be useful as a feedback system on key elements of the PSDDA plan as well as a help for those involved in dredged material regulatory evaluations or planning dredging projects. Continued port involvement in the development of this system is encouraged.

In summary, we have failed to note in the Draft, or in our close participation in the PSDDA process itself, any indication of serious attention being given to the actual circumstances or conditions under which evaluation criteria or procedures might be relaxed or costs reduced. Our experience in such matters does not make us feel optimistic. All indications to date are that the evaluation process and supporting data system are intended to evaluate program effectiveness from a very limited, technical point of view. (16)

We definitely expect to see more thorough coverage of this matter in the Final EIS. (17)

We hope that the significant time, effort and cost devoted to PSDDA thus far will not founder because of inadequate attention to the necessities of implementation. I assure you that the Port of Seattle will continue to work actively to realize the promise of the PSDDA process to meet its stated goal. (18)

Sincerely,

Walter D. Ritchie
Chief Engineer

DAG/bk
2846V

Response 16. See response Nos. 2, 13, and 15 above. Also see MPR chapter 9.4.

Response 17. See response Nos. 2, 13, and 15 above. Also see MPR chapter 9.4.

Response 18. We are very committed to giving the same attention to implementation as we have the study. Meetings and discussions among the PSDDA agencies from staff levels to the Policy Review Committee (heads of PSDDA agencies) are continuing on implementation. The study director has been given the responsibility to monitor and support the implementation process with feedback to the Policy Review Committee if problems occur which merit the committee's attention. We appreciate and welcome the Port of Seattle's continued involvement with PSDDA as has been conveyed in recent meetings with the port staff. The port has made very important contributions to the management plan.

Serve Our University Place

S.O.U.P.

4437 W. Granlview Place
January 15, 1988
Tacoma, WA. 98466

Mr. Frank Urabeck, Director
Puget Sound Dreigei Disposal Analysis Study
U.S.Army Corps of Engineers
Seattle District
P.O.Box C-3755
Seattle, WA. 98124-225

Dear Sir:

In general we question whether any area in Central Puget Sound near urban bays should be used for disposal of dreiged material. Shifting of possible toxic dredge materials from navigable waterways to nearby location could augment the environmental impact upon the urban bay. 1

Use of Elliot Bay is particularly questionable. The existing site is locatei where curents have carriei material to the beach below Magnolia Bluff. The preferrei disposal site is out of the current but has obly half the depth. It is closer to alreaiy contaminatei shoreline. Thus, there could be a cumulative effect from the placement of new dreigei material here. Also, some interference with ship ani ferry trafic will occur in this location. 2

In the preferred site of Commencement Bay, the disposal Zone will be exposei to greater current than the existing one. Shallowing ani narrowing of Dalco Passage causes tiial rips less than 4000 yaris from the site. 3

The Port Gariner proposei site will also be exposei to greater current. Presently the existing iisposal zone is protectei from current by shoal water lying to the north. The preferrei location will be bracked by this shoal ani another exteniing southeast from Geiney Islani. A smooth flat bottom inicates that currents sweep the area. 4

Dreigei material removei from urban bays of Puget Souni shoull be taken completely away from the highly contaminatei urban industrial environment. 5

Thank you for the opportunity to comment.

George H. Hess, M.D.

George H. Hess, M.D. for S.O.U.P.

RESPONSES TO SERVE OUR UNIVERSITY PLACE JANUARY 15, 1988 LETTER

Response 1. The PSDDA disposal sites will receive only relatively "clean" dredged material. Dredged material not found acceptable for unconfined, open-water disposal will be removed from the marine environment as a by-product of navigation maintenance and improvement projects and placed upland or at a "confined" disposal sites.

Response 2. See response No. 1 above. Dredged material placed at the preferred Elliott Bay site will actually be cleaner than the existing sediments (see FEIS section 4.08a(2)). The preferred site, while in the vicinity of heavy vessel traffic, is clear of established traffic lanes and within the control of the U.S. Coast Guard Vessel Traffic System.

Response 3. The preferred site in Commencement Bay is in a lower bottom current environment than the existing site (see FEIS, section 3.02a(3)).

Response 4. The Port Gardner preferred site is in a very low current environment with all material discharged at the site expected to remain within the site boundaries (see FEIS, Sections 2.03k and 4.14a).

Response 5. See response No. 1 above.

Rd 2/25/88

PNWA
Pacific Northwest Waterways Association
P.O. Box 61473—Vancouver, WA 98666
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February 19, 1988

Frank Urabeck
Seattle District
U. S. Army Corps of Engineers
P. O. Box C-3755
Seattle, WA 98124

Dear Mr. Urabeck:

Since the inception of the Puget Sound Dredged Disposal Analysis (PSDDA) work the Pacific Northwest Waterways Association (PNWA) has supported the efforts of the Seattle District, Corps of Engineers, to establish the ground rules for management of dredged materials in the Sound. On behalf of the membership of PNWA, I appreciate this opportunity to respond to the recently circulated draft plan.

Before offering our comments on the plan, a brief explanation of PNWA's interest in PSDDA is appropriate. PNWA is a regional association with members in Idaho, Oregon and Washington. Our member ports, utilities, engineering firms, agricultural and financial organizations support the appropriate development of the Northwest's water resources for the economic health of the region.

Our members around and outside the Puget Sound know that the area has long relied on water-dependent commerce and trade. As the PSDDA report points out, marine shipping alone provides as many as 100,000 jobs in the Puget Sound area. The need for dredging for shipping channels, berths and harbors to maintain that economy is unlikely to decrease. And disposal of the materials must be done in a careful and economic manner. For this reason, the promulgation of well thought out, equitably established standards for the disposal of dredged materials in Puget Sound is important.

The draft plan outlines such a program for the unconfined open-water disposal of dredged materials in Central Puget Sound. In the recent past, the lack of agreement on and standards for disposal were serious stumbling blocks to the growth of the area's important waterborne trade. Under earlier conditions, the cost of dredge disposal, if indeed agreement could be reached on how to dispose of materials, made some work economically impossible. This draft plan is the first essential step in providing standards that will make planning for needed maintenance and development possible.

We would like to reinforce two aspects of the PSDDA report:

1. The Puget Sound is a unique area in the Northwest. The standards in the PSDDA draft plan were developed specifically for that area. The draft plan recognizes this singularity. PNWA urges that the standards established by PSDDA, developed for the Sound, be used only in dealing with the Sound. 1

2. There is significant testing of dredged materials called for under the draft plan. Although this will increase the costs of dredge disposal, the information will help in further establishing standards for disposal. We would ask that the need for extensive testing be reviewed in a timely manner so that only those tests which are essential be required of all projects. In that way, the cost of maintenance of essential projects will be contained. 2

The Seattle District, Corps of Engineers, has done an excellent job with a complex issue. On behalf of PNWA's members, I would like to extend our appreciation for your efforts and offer our continuing support as you enter into Phase 2 of the study.

Sincerely,

PACIFIC NORTHWEST WATERWAYS ASSOCIATION

Peggy Bird

PEGGY BIRD
Executive Director

PB/cav

cc: John Fratt, Port of Kalama
Dale Alldredge, Port of Lewiston
Don Moos, WPPA

RESPONSES TO PNW 19 FEBRUARY 1988 LETTER

Response 1. Comment noted. We fully agree that the PSDDA Management Plan only applies to Puget Sound.

Response 2. Comment noted. We fully agree. See response No. 11 to Port of Tacoma letter.

Seattle Audubon Society

Washington Nonprofit Corporation
619 Joshua Green Building • Seattle, WA 98101 • 206-622-6695

27 February 1988

Frank J. Urabeck, Study Director
U. S. Army Corps of Engineers
Seattle District, PO Box C 3755
Seattle WA 98124-2255

Dear Mr. Urabeck:

The Seattle Audubon Society is comprised of about 5,000 members and is incorporated as a non-profit (501 C-3) organization within the State of Washington. Most of our members reside in the Greater Seattle Area. The Seattle Society, like its counterpart groups country-wide, is dedicated to the protection and preservation of fish, wildlife, plants and their habitats, and to the conservation and wise use of energy and natural resources. Seattle Audubon members have long been involved with efforts to protect and clean up Puget Sound and were active in the development of the State Shorelines Management Act. The Society currently is associated with the challenge of the Everett Homeport shorelines permit, and with other actions relating to the protection of water quality in the Sound.

Given the foregoing, the Seattle Audubon Society appreciates the opportunity afforded through its Conservation Committee and other elements of the Society to review the draft "Proposed Management Plan for Unconfined Open-water Disposal of Dredged Material", and the accompanying Draft Environmental Impact Statement. We commend your thorough analysis of such an important and complex topic.

We are generally supportive of the approach being recommended in the draft documents. However, we offer comments on three specific elements:

1) We appreciate the potential lack of suitable alternatives; however, we are concerned about the proximity of the preferred disposal site in Port Gardner to the proposed "CAD" site for the Navy Homeport. The relative nearness of the two sites to each other may obscure monitoring efforts at either one, and potentially could lead to adverse cumulative effects on the marine environment. We encourage the study team to re-evaluate potential alternative sites if the preferred site is chosen. 1

2) The Draft Report indicates that the preferred site management condition is Site Condition II (minor adverse effects"). Although this site condition assumes that adverse effects will take place only within the site boundary (if at all) we would suggest a movement toward Site Condition I, or "no adverse effects", over the long term. Additionally, we would suggest careful monitoring around the disposal sites to ensure that the real effects of the site condition are not 2

exceeding the presumed ones.

3) Page I-39 of the draft "Technical Appendix Management Plans Phase I" indicates that monitoring of bottom-dwelling organisms is not proposed as part of the monitoring program for Elliott Bay. However, we urge that the Army Corps Study Team reconsider the matter of including long-term biological monitoring for Elliott Bay, comparable to such monitoring suggested for the other sites. 3

Thank you again for the opportunity to comment.

Sincerely yours,

ROBERT Y. GRANT, Chairman
Conservation Committee

RESPONSES TO SEATTLE AUDUBON SOCIETY 27 FEBRUARY 1988 LETTER

Response 1. Comment noted. We have reexamined the alternatives to the preferred Port Gardner site, including a site suggested by Mr. Terry Williams of the Tulalip Indian Tribe located west of Gedney Island. See response No. 2 to PSWQA letter.

Response 2. Over the long term, with adequate control of pollution sources, we would expect that the quality of surface sediments at the disposal sites will approach Site Condition I. However, please see response Nos. 3 and 9 to the NMFS letter.

Response 3. We have revised our monitoring plan (see final Management Plans Technical Appendix, exhibit 1) to include offsite biological stations for the Elliott Bay disposal site. Offsite biological stations were established during the baseline work accomplished in May 1988. Biological stations may be continued into future monitoring, depending upon the degree of variability in the data collected during baseline work which affects the ability to differentiate changes due to shoreline pollution sources from those that may be due to the disposal site - although none are expected from the site.

SIERRA CLUB - CASCADE CHAPTER

Mr. Frank Urabeck
Study Director
Puget Sound Dredge Disposal Analysis (PSDDA)
US Army Corps of Engineers, Seattle District
P.O. Box 3755
Seattle, WA 98124-2255

28 February 1988

Dear Mr. Urabeck,

The Cascade Chapter of the Sierra Club has carefully reviewed the the "Draft Environmental Impact Statement" (DEIS) and the "Draft Proposed Management Plan" (PMP) for the Puget Sound Dredge Disposal Analysis (PSDDA).

Our initial analysis of both documents however did not provide the substantive technical and scientific information necessary for us to meaningfully assess the environmental protection worth of the the proposed PSDDA. We consequently obtained copies of the technical appendices:

- o Draft Evaluation Procedures Technical Appendix (EPTA). (1)
- o Draft Pproposed Management Plan (PMP).
- o Draft Site Selection Technical Appendix (DSSTA)

The results of our analysis shows that, even for a reviewer well versed in the subject matter, the voluminous documents are difficult to read, the dispersed and fragmented presentation of the material difficult to cohesively analyze for substance.

Thus by necessity our comments will be brief, concentrating on the substantive rather than details.

We fully concur with the needs for a certain amount of dredging to keep our maritime commerce and various other navigational (2) facilities operational. We have no objection per se to open-water disposal of clean, environmentally complient, unpolluted dredged material.

We however steadfastly maintain our position that the "non-degradation" of the marine environment of Puget Sound is the paramount and overriding requirement. Any "use" of the marine (3) environment of the Sound must fully abide by the non-degradation commitment.

Our non-degradation position is that only sediments with inorganic/organic properties similar to those of the natural, unpolluted sedimentary background of the Sound (e.g. pre-1900, (4)

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RESPONSE TO SIERRA CLUB, CASCADE CHAPTER, 28 FEBRUARY 1988 LETTER

A meeting of Dr. Pat Wennekins and representative of the four PSDDA agencies was held on April 6, 1988 to discuss his concerns. The following responses are reflective of those discussions.

Response 1. Comment noted. Management Plan Report (MPR) provides the lay reader with an overall view of the total PSDDA management plan. The various plan elements are described in the MPR in some detail with the reader referred to the EIS and other supporting documents for expanded discussions.

Response 2. Comment noted.

Response 3. The PSDDA Management Plan is consistent with Federal policies contained in the Federal Water Quality Standards Regulation (40 CFR Part 131). These policies deal with anti-degradation and apply to the area beyond the disposal sites. Some short-term lowering of water quality is expected during disposal of dredged material at these sites but little or no water quality impacts are anticipated beyond the site boundaries. The PSDDA dredged material evaluation procedures allow only relatively clean sediments to be discharged at the sites. Monitoring, included as part of the plan, will be conducted to verify our predictions. Site management adjustments will be made if monitoring indicates this is needed.

Response 4. Extensive national research on the effects of dredged material disposal into aquatic systems suggests that this position is unnecessarily restrictive (see response Nos. 1, 3, and 9 to the NMFS letter). Site Condition II (SC-II) that has been adapted for all the Phase I disposal sites, is not based on the use of "contaminated" sediments as a reference for what quality of material can be placed at these sites. Reference areas used in the PSDDA evaluation procedures are from "clean bays" located outside the contaminated urban embayments. Reference sediments are used in a suite of biological tests that are used to make the final determination of "acceptability." Acceptability is defined in chapter 5 and exhibit A of the MPR and in the Evaluation Procedures Technical Appendix (EPTA) when testing procedures and disposal guidelines are described.

Reference Bay levels) can be disposed of in open-water.

(4) We cannot support a policy that condonnes disposal of polluted material at an already contaminated disposal site "as long as the level of contamination in the dredged material is not significantly more polluted than the sediments of the site".

The most dismal and environmentally damaging flaw of such a practice is that <u>the contaminated level of a polluted site becomes the reference level for environmental quality.</u> As an extreme corollary, the contaminated level of a "Love Canal" site becomes the acceptable level for the disposal of hazardous wastes as long as the toxic levels of the solid wastes does not exceed the "Love Canal" levels !.

Our analysis of the proposed PSDDA course of action remains essentially "more and even worst" of the above, with the argument that open-water dumping of polluted material "will not result in unacceptable adverse impacts" without specifying first by what is meant by unacceptable. Thus "if there is a reason to believe" that the "adverse impacts" are "acceptable" then it is OK to continue polluting Puget Sound to "acceptable" levels, a rather dismal and perverse practice of abiding by the state/federal non-degradation policy.

(5) We fully endorse the 1986 Puget Sound Water Quality Authority (PSWQA) position that:

> "The fact that significant sediment contamination exists in Puget Sound, when water quality is considered good, implies that existing water quality programs have not protected the sediments from degradation".

We also fully concur with the statement (PMP, p. 2-13):

> "Traditional water quality evaluation procedures alone were no longer considered sufficient for assessing the pollution-related impacts at the disposal sites".

Such statements reinforce our past contentions that particulates, especially fine (less than 2 microns) clay-colloidal size particulates are the main binder and carrier of a wide array of inorganic/organic toxicants, a fact well recognized and documented but unfortunatly so far steadfastly avoided by waste water "managers" regulatory and control practices.

Recurrent statements such as:

(6)

o - "More dredged material is expected to be found acceptable for unconfined open-water disposal under PSDDA evaluation procedures as compared to the interim criteria".

o - "This (No Action Alternative) would result in very

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<u>Response 5</u>. Comment noted.

<u>Response 6</u>. We disagree that the PSDDA plan represents a "liberalizing" of environmental protection safeguards. Rather, the plan is based on extensive technical discussions and reflects input and evaluations by regional and national experts with considerable public involvement to ensure that the marine environment is protected while allowing cost-effective disposal of dredged material. The plan complies with all applicable Federal and State laws.

The present screening levels (SL) and maximum levels (ML) are considered to be established at environmentally conservative values. As additional synoptic sediment quality data are collected, involving both chemical and biological tests, the SL and ML values will be reassessed. However, adjustments will only be made to the disposal guidelines when the data clearly demonstrate this action to be warranted.

Because testing is very expensive we will reassess annually the need for the currently prescribed tests to determine if appropriate adjustments in testing requirements are warranted. However, adequate environmental safeguards will be maintained. The intent is to have cost-effective and cost-reasonable testing that meets environmental protection objectives.

> limited unconfined, open-water disposal in Puget Sound due to both the application of the PSIC (Puget Sound interim guidelines and discontinuation of public multi-users disposal sites .... because local governments have established shoreline permit conditions for a multiuser site that could not be met by moost dredgers". conditions for a multiuser site that probably could not be met by most dredgers".

6

leaves the reader with the uneasy feeling that the proposed PSDDA program is a scheme to "liberalize" the environmental protection safeguards previously imposed to control and limit unfettered disposal of POLLUTED (emphasis on POLLUTED) dredged sediments into Puget Sound. One must point out that the local governments did not object to the open-water disposal of UNPOLLUTED dredged material. The DEIS must specifically rectify this misnomer.

A number of other statements also reinforce our unease about federal/state governmental commitments to protect and maintain a "clean" Puget Sound. While seemingly quoted "out of context" the following deepens our concerns:

o - Footnote 1/ at the bottom of PMP Table A.7., p. A-15.

> The screening level (SL) and the maximum level (ML) values reported here are likely to be adjusted upward by on-going review of the data base".

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The footnote clearly implies that the SL and ML levels will be liberalized so that open-water disposal of contaminated sediments will be more "publicly acceptable".

o - DEIS, p.S-22, under "Review and Revisions":

> " .... provision is made in the management plan for annual assessment of the data obtained .... from regulatory action, ... and environmental monitoring of disposal sites after they have been in use. .... environmental monitoring and costs aspects of the plan will be reexamined. <u>One result may be a reduction in the level of testing and monitoring</u>".

Apart from the issue of how effective monitoring of an ecosystem might be by being able to differentiate between changes stemming from pollution and those induced by natural fluctuations, past experience with agencies "environmental monitoring" performances leaves us with an unsettling feeling that "cost aspects" will drive the excuse to reduce the level of testing and monitoring.

<u>Proposed Dredge Material Evaluation Procedures</u>

Combinations of Chemical, "Apparent Effects Threshold" (AET), bioassay and bioaccumulation tests will serve to define "acceptability" of polluted dredged material for open-water disposal

7

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<u>Response 7</u>. The PSDDA DEIS and FEIS address the range of alternatives necessary to evaluate the potential environmental consequences to the significant resources of the Sound. The key features of the PSDDA Management Plan that govern environmental impacts are the location of the sites and the biological effects conditions selected for site management (the site management condition). Consequently, the FEIS focuses on these two features of primary environmental concern: alternative site locations (what resources exist at and near the alternative site locations) and alternative site management conditions (what degree of adverse effects on biological resources due to sediment chemicals of concern is acceptable). Evaluation procedures (including testing requirements and disposal guidelines) and environmental monitoring will be used to achieve, verify, and ensure that the selected site management condition is not being exceeded. Laboratory tests provide a means of inferring what may occur in the field. However, national research on dredged material disposal in open-water has shown that the laboratory tests tend to overstate environmental effects at the disposal sites. We expect field conditions to be better than allowed under SC-II. These will be checked through environmental monitoring which is not only a necessary verification step, but also serves as the key feature that will allow adjustment of the evaluation procedures, if needed, to avoid unacceptable site conditions. Further discussion of the relation between evaluation procedures and the FEIS alternatives is contained in section 2 of the FEIS. With regard to AEIs, see response No. 9 below.

An AET refers to the concentration of a contaminant in sediment above which statistically significant biological effects (i.e. mortality of test species, depression in abundance of benthic infauna) would always be expected. 7

Attempting to assess the environmental protection effectiveness of an AET approach required sorting through the murk of all five documents. The DEIS which in fact should be the document which provides the reviewer with a <u>clear and concise</u> explanation of the scientific/technical <u>basis leading to the development</u> of an AET for decision making, the DEIS is silent on the subject. Instead, the reviewer is referred to the Draft PMP and EPTA document for further enlightenment.

The murk thickens as the reader plows through Chapter 5 and Appendix A (PSDDA Dredged Material Evaluation Procedures) of the EPTA.

Apart from the similarities between Fig. 5.2 of the PMP and Fig. II.2-3 (PSDDA Testing Sequences) of the EPTA, the reader has a difficult time to correlate the substance of the information presented in sections 5.4.2. through 5.5.9 of the PMP and sections 7.2.2. through section 7.5.1. of the EPTA.

Taking the graphed "PSDDA Testing Sequences" as a guide, a basic question arises as to how the SL and ML values presented on Table A.7, pp. A-14 and A-15 of the PMP were derived to implement the "Tier 2 " decision levels referred to in Fig. 5.2.. Telephone queries on how SL and ML values were derived elicited the reply that information developed in a prior PSDDA report titled: "Development of Sediment Quality Values for Puget Sound" (Tetra Tech 1986 j. Ref. p. IV-7, PMP) needs to be researched to clarify the issue. 8

Intercomparison between the two documents of the analytical procedures used to develop the AET criteria indicates that the same chemical/ biological data base is used in both the PMP and the Tetra Tech 1986 j documents. The figures illustrating the "Location of Chemical and Biological Samples included in the Puget Sound Data Base" are identical (e.g. Fig. II.7-1, p. II-8 in the PMP document). Table 2. showing the "Summary of Data Sets Used in this Project" (p. 41 of the Tetra Tech j reference) shows that a complete suite of chemical/bioassay (including Microtox), toxic induced depressions in the abundance of major benthic taxonomic groups was performed at only one site, Commencement Bay (see enclosure 1).

Thus the statement on p. II-89 of the EPTA:

> "The Commencement Bay data base was expanded to include sediment chemistry and bilogical effects information from additional nearshore urban/industrial areas and "clean" 9

<u>Response 8</u>. Additional clarification explaining the development of the PSDDA <u>chemical disposal</u> guidelines has been provided in section II-7.2 of EPTA and in chapter 5 of the MPR.

<u>Response 9</u>. The apparent effects threshold (AET) approach to developing sediment quality values only relates chemical concentrations to single biological indicators, i.e., the AET value for a given chemical is specific to a specific biological test. Other biological tests may have different AET values for the same chemical. There is no requirement or method for deriving AET values for multiple biological tests. Thus, any combined assessment of chemistry and biology can be used to derive AET values. Multiple biological tests at a single site are not a prerequisite, nor are they considered in setting indicator specific values. Nonetheless, the Puget Sound data base has been recently expanded by EPA to include several large chemical and biological data bases that do include multiple biological tests at many stations. This expanded data base significantly contributes to the strength of the resulting AET values.

Completed and ongoing scientific review of the AET method and values is resulting in increasing recognition of the applied strengths and management utility of the AET approach to the development of sediment quality values. During development of the SL and ML values, the AET values were tested to determine their ability to correctly predict toxicity in the Puget Sound data base. The reliability of SL and ML values was also tested on several case projects. Testing of the SL and ML values with the recently expanded Puget Sound data base has also been accomplished. The SL values have been shown to be environmentally sensitive and the ML values have been shown to be cost effective. Whenever sediment chemistry values lie between SL and ML values, a suite of biological tests are conducted to establish the acceptability of the material for unconfined, open-water disposal.

One of the strengths of the AET approach in relating sediment chemistry to adverse biological effects is that it relies on empirical, field evidence. In deriving sediment quality values from sediments that contained multiple chemicals, interactive effects (especially those that are frequent in their occurrence in the Sound) are "built in" to the results. The more "representative" of Puget Sound that the data base is, the stronger the ability of the AET system to predict adverse effects. This accounts for the strong "performance" of the AET values in correctly predicting the presence or absence of biological effects. It is this reliability that justifies the use of the SL and ML values in Puget Sound regulatory applications at this time.

Further discussion concerning the scientific acceptance and validity of the AET concept and the relationship of the AET values to the proposed PSDDA SL and ML values has been added to the text in section II-7.3 and II-7.4 of EPTA.

> reference sites. .... The data was then used to identify the concentration of each chemicals above which no sample examined was found to be without biological impact. This concentration referred to ... as AET, was identified on a chemical specific basis for 71 chemicals for each biological test independantly (i.e. amphipod, oyster larvae, Microtox bioassay and benthic community analysis)".

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might not be as reliable as the above statement implies. Based upon the scope of the information thus provided, one might conclude that the derived SL and ML values of Table A.7 reflect only assumptions based upon a marginal set of chemical/biological and statistical data. In our opinion, the validity of the AET and SL/ML values presented in the EPTA document is questionable and requires further substantiation prior to any considerations of their applicability to open-water disposal of "acceptable" polluted dredged material.

<u>"Screening Levels" - "Maximum Levels": WHAT ARE WE BUYING?</u>

10

The basic questions that arise from plowing through the murk are: what are we buying in terms of effective, long range preservation of the environmental quality of Puget Sound. What are we buying in term of the restoration of benthic sites already polluted as a result of past and present pollution control malpractices?. What are we buying in terms of the Clean Water Act stated objective to <u>restore and maintain</u> the *chemical, physical and biological* <u>integrity of the Nation's waters</u>?. What are we buying in terms of the national policy that "discharges of toxic pollutants in toxic amounts be prohibited"?.

The proposed PSDDA use of AET, SL and ML as criteria to determine the "acceptability to open-water disposal" of <u>contaminated</u> dredged material raises the issue of how implementation of the PSDDA program complies with the national policy that: "discharges of toxic pollutants in toxic amounts be prohibited" ?. In addition, the Clean Water Act stipulates "that the discharge of pollutants be *eliminated* " (*the stipulation is still part of the Act as amended in 1987*). The Act requires a phased program of ever more stringent controls to "restore" damaged waters and maintain a high quality aquatic environment. Regulations mandates strict adherence to a non-degradation policy. The DEIS and DPMP while acknowledging the various federal and state laws established to restore, maintain and protect aquatic quality essentially ignore the substance of the legal/regulatory requirements for imposition of ever stricter pollution control measures.

<u>Intercomparaison Between PSDDA, PSIC and "Reference Bay" Toxic Levels</u>

11

Verification of the claim that:

<u>Response 10</u>. The PSDDA plan is consistent with the Clean Water Act goals, objectives, and requirements to protect the aquatic environment. As pollution sources are diminished through other ingoing programs, the bottom sediments in the navigation waterways will gradually be improved resulting in cleaner dredged material. See response No. 3 above and No. 11 below regarding the nondegradation issue.

"More dredged material is expected to be found acceptable for unconfined, open-water disposal under the PSDDA evaluation procedures as compared to the interim guidelines (PSIC)".

can be found in Fig. II 11-5, II 11-6 and II 11-7 (pp. II-207 to II-209) of the EPTA document (see enclosures 2 and 3)

Careful examination of the depicted levels indicates that PSDDA will promote a substantial liberalization in the application of toxic levels. Our position is that, based upon the the data depicted, the "Reference Bay" levels <u>are</u> the reference "clean" Puget Sound levels from which "accptability" for open-water disposal must be based.

The PSDDA relaxation of pollution control to facilitate open-water disposal of contaminated dredged material is demonstrated by the 10 fold SL and an 200 fold ML increase in PCB levels as well as by other similar increases for other contaminants over "Reference Bay" levels. Our position is that "non-degradation" requires that the "pollutional" level of dredged material remain below the "Reference Bay" levels.

Response 11. Based on the data used to arrive at the SL and ML values, and the fact that a suite of bioassays are also required, significant toxic effects are not anticipated at the disposal sites. For example, the PCB screening level is well below the Puget Sound Interim Criteria (PSIC) values.

Sampling, Nepheloid Layer, Dilution Zone

PSDDA determination of what would be acceptable for open-water disposal will be based upon the concept of a "dredged material management unit" (DMMU) which would determine the number of analyses that would be required for a given dredging volume.

Arguments are presented (e.g. PMP, p. A-10) for the maximum volumes of sediments required to trigger contaminant testing. (i.e. one analysis for every 4000 c.y. of material above 4 foot cut depth, the 4 foot cut depth being apparently the thinnest layer current equipment can dredge).

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Response 12. Chemical testing requirements do vary by project volumes, depending on the degree of chemical concerns that exists in the project area. In areas of "high" concern (see area ranking discussion in MPR, exhibit A), all projects require some testing (or comparable existing data), regardless of size. For projects in moderate or low-moderate ranked area, any projects with volumes greater than 500 cubic yards would require testing (or existing data). In areas of documented low concern, the "no-testing" volume is 8,000 cubic yards. In addition, when dredging will cut deeper than the 4-foot line, testing information is required of the subsurface sediments as well. Further discussion of small project testing requirements is contained in section II-3.2 of EPTA.

Recurrent reference is made to composite several samples primarily to reduce the amounts of analysis and especially cost. How much such compositing of sample will help dilute the polluted material to "acceptable" levels is left unanswered.

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Response 13. Compositing of environmental samples is a standard tool for minimizing variability and improving the extent to which the sample is representative of the dredging prism. In recent past practices, decisions concerning material acceptability for unconfined, open-water disposal were often made on a project basis using only a few samples. By relying on the "dredged material management unit" concept, PSDDA has proposed to increase the number of samples and analyses, as well as to limit the extent of sample compositing that is allowed. By definition, dilution will still occur within the management unit, but mixing of separate management units is not allowed. Available information suggests that added mixing is more likely to introduce unacceptable chemical concentrations (e.g., from surface sediments) to otherwise acceptable material (e.g., subsurface sediments). Consequently, it is expected that some dredgers may elect to take more samples than the minimum required by the PSDDA guidelines. In any case, by requiring that subsamples of the individual, noncomposited samples be archived, separate analysis of the chemical contribution of individual samples can be required when warranted.

One serious flaw in the PSDDA sampling and analytical protocols is the lack of emphasis placed upon particle size and location of the bulk of pollutants within the sedimentary matrix.

The statement from sections 3.4.1 and 3.4.2, p. III-12, EPTA document that:

"Separation of chemicals of concern from the dredged material is a method of reducing the amount of material that must be placed at confined disposal areas. Typically, contaminant separation schemes result in a large volume of

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Response 14. Potential particle size segregation of chemicals of concern was addressed. Fine-grained normalization of sediment quality values was considered. However, the resulting values proved to be substantially less reliable than simple dry weight normalization. Also discussed was a mass concentration test for estimating suspended chemical losses. After extended assessment, it was concluded that the technical model and technique for such a test is not currently available.

However, several features were incorporated that did address this issue. First, the sediment larval test is a 48-hour exposure to the suspended and dissolved fractions of the sediment. The 96-hour water column oyster larvae test also assesses the adverse effects of suspended sediments and their associated chemical concentrations. Either of these two tests provide a specific assessment concerning the toxicity of the potentially suspended fraction. By agitating the sediment in water prior to conducting the test, a "worst case" exposure environment is created, overestimating the predicted suspension that would occur during disposal.

relatively uncontaminated dredged material and in a smaller volume of highly contaminated material" (14)

is most significant. It underscores the well known and documented knowledge of the intimate bounding between contaminants and fine clay-colloidal size particles. The continued lack of consideration to the pollution control benefits that would accrue from the selective removal of the highly contaminated fine (2 microns or less) fractions reflects the still traditional emphasis to dump the entire dredge volume into open waters.

(15) As such the proposed PDDA program essentially by-passes the technology based control at the source requirements of the Clean Water Act,

(16) We take the position that physical separation of the fine, contaminated particulates from the dredging material together with contaminant separation, contaminant extraction, chemical immobilization and disposal of the residuals at specially located, engineered and controlled disposal site must be considered as the prime preferred alternative to long term protection and preservation of Puget Sound marine environment.

(17) The Draft EIS and associated technical documents must be restructured and redrafted to give technology based, source control of sediment contaminant removal alternative first priority.

(18) The controlling role played by fine particulates in the concentration and transport of the bulk of contaminants becomes of special significance when condidering the behavior, fate and effects of particles/contaminants in turbid plumes and nepheloid layers.

(19) The impacts of a turbid plume is more than just the physical alteration of the optical properties of the water. The turbid plume consists of the mix of toxic bearing clay-colloidal size organic and inorganic particles. As such turbidity must be considered as a "toxic cloud" known to layer out at density interfaces (Fig. II.7-1, DSSTA, p. II-133). Planktonic and larval organisms accumulate at density interfaces, such interfaces acting as "floors and ceilings" helping reduce the amount of energy required for buoyancy or swimming control. Contrary to prevailing assumptions that "turbidity" has only momentary, small, transient biological impacts, major condideration must be given to the fact that once the particles become trapped by the density interfaces, such interfaces act as subsurface "microlayers" intermingling highly polluted particles with concentrations of planktonic and larval forms. Density interfaces inhibit mixing, dispersive transport of pollutant-biota being mostly along the density interfaces. Under such conditions, application of a "mixing zone" concept becomes mostly irrelevent.

The loss of sediment particles during disposal was modelled prior to site selection to assist in defining proper siting guidelines and to assess the potential significance of this pathway (see the Disposal Site Selection Appendix (DSSTA) for details). The estimated 1 to 3 percent loss during disposal (most associated with the bottom impact of the discharged mass) is not considered a significant contaminant vector. Material that settles in these sites is not expected to be resuspended due to the low currents that exist there. Nonetheless, environmental monitoring of the disposal sites will assess the observable effects in the field (see HPTA, exhibit 1). Chemical tests of the sediments outside the site (at the perimeter line) and biological monitoring of benthic abundance and tissue concentrations (at the designated gradient station) will provide the necessary information to verify that suspended sediments are not adversely affecting the site environment. The use of offsite benthic infauna is considered to be the best indicator of offsite transport of chemicals of concern, as they will provide an integrated record over time.

Treatment of dredged material prior to unconfined, open-water disposal is discussed in EPTA, section III-3.4.1. In general, separation methodologies are not practicable for most projects. They have not been demonstrated to be cost effective for contaminant separation for the volumes associated with most dredging projects, and are very costly overall (multiple rehandling of the material is necessary). In addition to requiring a large site for settling of the hydraulic separation effluent, the process generates large volumes of water that represent added environmental concerns for loss of dissolved and suspended chemicals during dewatering. For these reasons, it was concluded that separation and other developmental treatment technologies are not appropriate for most projects.

Response 15. While the Clean Water Act addresses the original discharge of pollutants into the aquatic environment on a technology basis, Section 404 of the law establishes a separate and effects based approach to regulating the discharge of dredged and fill material into waters of the United States. The Act requires that the discharge of dredged material not result in an "unacceptable adverse effect" to the aquatic environment. In the implementing regulations (Section 404(b)(1) Guidelines), this requirement is translated as the "least environmentally damaging practicable alternative."

Response 16. The position of the Sierra Club, Cascade Chapter, is acknowledged. For the reasons described in the response No. 14, these treatment technologies are not considered to be appropriate or necessary for material that is found to be acceptable for unconfined, open-water disposal.

Response 17. We agree that control of pollutants at their original source is the critical element in pollution abatement and improvement of chemical levels in aquatic sediments (see MPR chapter 2). Dredging of itself is not a source of chemical pollution. However, the dredger is often taxed with the cost of special disposal due to contamination by others of sediments lying in waterways and berthing areas. Eliminating the input of chemicals of concern will benefit the dredger and the environment.

Response 18. We agree.

The same argument applies to the nepheloid layer. Under "Key Contaminant Pathways" (EPTA, p. II-24) the nepheloid layer is defined as a "...a mobile layer of unconsolidated "fluff" overlying the bottom sediments". The reference also states:

> "Lateral transport of the suspended matter in this bottom nepheloid layer (net southward transport and extending up to 50 meters from the bottom) in Central Puget Sound has been estimated to be a 1000 times as great as the vertical transport in the column. Unconfined, open-water disposal sites are selected in part because of low current regime that favor deposition rather than dispersion. Hence dispersal of dredged material in the nepheloid layer is expected to be an important pathway only for a short time during and after disposal".

In the "Fate of Dredged Material Section" (DSSTA, pp. II-119 to II-131), of interest is the discussion of off-site transport of material remaining in suspension. While little or no verification of actual amount of material that would remain in suspension after a dump, "conservative modelling" estimates suggest that between 1 and 2 percent of the material could remain in suspension. The unverified 1 to 2 percent assumption suggests that the amount of suspensoids contributed to the nepheloid layer would be small (i.e. 80 c.y. for a 4000 c.y. dump). The ecological importance of the small amount of suspensoids can however be highly significant if the suspended particles carry high levels of toxics. Information about the actual pollutional levels of the nepheloid layers in the Sound is almost nil. The very presence of a nepheloid layer suggests presence of very fine clay to colloidal size particles, particles which are the prime carrier for a wide mix of contaminants. Additional influxes of such particles, even in seemigly small amounts in the nepheloid layer cannot be ignored. The size of the particles make them readily available for biological uptake. The pollutional ecology of the nepheloid layer has been ignored too long. Its importance to the pollutional processes of the Sound needs to be ascertained to properly understand the fate and effects of dreged material disposal upon the benthic environment of the Sound. Its importance lies in the fact that through hydrodynamic particle size sorting, the nepheloid layer can be expected to be more toxic than the deposited material. 20

SUMMARY and CONCLUSIONS

The Sierra Club - Cascade Chapter cannot support nor endorse the intent and susbtance of the PSDDA.

The PSDDA documents, all five of them, are tedious and difficult to read, the information highly fragmented, often defying the reviewer's attempts to cohesively sort and arrange the material in some logical order to facilitate its comprehension. 21

Response 19. See response No. 14 above. Current information indicates that significant turbidity associated with dredged material disposal will remain at "density interfaces" for only a short time (1 to 2 hours, depending on the tidal currents and physical characteristics of the material). The turbidity associated with the discharge of only two to four barge loads per day (1,500 cubic yards per barge) (see PEIS table 4.9) is far less than that from river discharges into all three of the Phase I area embayments. This occurs during storm periods, springtime snow melt, and in the case of Commencement Bay, via glacial runoff during the summer. Prevailing assumptions are based on research conducted by the Corps and EPA through the Field Verification Program (FVP). See MPR chapters 1 and 5 and EPTA Part II, Section 1. Research conducted in Elliott Bay by NOAA scientists has not shown density interfaces to exist except near the surface due to freshwater passage from rivers.

Response 20. Please see response Nos. 14 and 19 regarding the impacts and consideration of suspended sediment losses during dredged material disposal. These possible adverse effects are already considered in the PSDDA evaluation procedures (prior to disposal) and in the site environmental monitoring (after disposal).

Response 21. The documents are complex, reflecting a comprehensive treatment of highly technical issues. We have attempted to improve clarity where possible.

22 The document in effect <u>ENDORSES AND PROMOTES CONTINUED POLLUTION of PUGET SOUND.</u> The dredged material evaluation procedures, the decision making processes leading to open-water disposal of <u>contaminated</u> sediments, the site selection procedures which in effect expands the areas of pollution, the lack of active promotion for technology based source control to <u>prevent</u> dumping of <u>polluted</u> sediments into the Sound, all underscore a program of contiaued, planned pollution.

23 We cannot support the PSDDA underlying concept of defining what is "acceptable" for open-water disposal on the basis of an "Apparent Effects Threshold" when such AET requires an "how much can we stress biota with contaminants before it begins to die or get sick !" as its level of reference to environmental quality !.

24 We regard the PSDDA documents, all five of them, as preliminary progress reports attempting to rationalize conceptual commitments to allow continued open-water dumping of polluted dredged spoils. The PSDDA document can be used for research planning, NOT FOR AUTHORIZED DREDGING AND OPEN-WATER DISPOSAL of <u>CONTAMINATED</u> DREDGED MATERIAL.

25 We do not oppose the open-water dumping of UNPOLLUTED material, material whose chemical composition and biological assays conform to those of "pre-1900" or "Reference Bay" sediments.

26 Our position is that NON DEGRADATION of the marine environment of Puget Sound <u>is</u> the primordial and overriding requirement.

27 We take the position that technological control for the removal of contaminated sediments at the source, through physical separation of contaminated particles, contaminant extraction, contaminant immobilization for subsequent disposal in upland confined containement sites must be given an overriding priority over open-water disposal of polluted dredged material.

28 We strongly recommend that EPA and DOE convene not less that one public workshop in Seattle, Everett, Anacortes, Tacoma, Bremerton/Silverdale/Port Orchard and Port Townsend to discuss and seek public concurrence for an <u>interim</u> dredge disposal R&D program encompassing not less than <u>three</u> full dredging seasons that would include:

1 - A thorough assessment by the Corps of Engineers of the most minimal amount of dredging necessary to maintain a basic maritime commerce.

2 - Use of the Puget Sound Interim Guidelines (PSIC) as the baseline to set the " pollutional level of acceptability" for open-water disposal of dredged material at the existing Four Mile Rock and Port Gardner Site.

<u>Response 22</u>. To the contrary, the PSDDA Plan will result in improved protection of the marine environment. See the FEIS.

<u>Response 23</u>. Please see response No. 9 concerning the AET use by PSDDA in developing reliable SL and ML values.

<u>Response 24</u>. Comment noted. We strongly disagree. As set forth in the PSDDA <u>documents</u> (see MPR, Executive Summary, <u>Puget Sound Pollution and Contaminated Sediments</u>) we will only allow the disposal of uncontaminated dredged materials at the preferred disposal sites. The PSDDA evaluation procedures (most restrictive now in existence nationwide) are designed to avoid unconfined, open-water dumping of "polluted dredged spoils."

<u>Response 25</u>. Noted. However, we do not believe this position is realistic in a regulatory sense nor that it is in accordance with existing law.

<u>Response 26</u>. Your position is noted.

<u>Response 27</u>. Noted. See response No. 14.

3 - Dredge material with contaminants in excess of the PSIC to be physically isolated through selective dredging, particle size separation or other techniques for non-water confined disposal.

4 - Investigate the behavior, fate and effects of open-water disposal of dredged material not exceeding PSIC levels during during open-water disposal operations at the Four Mile Rock and Port Gardner sites.

5 - Report on the results of technology based controls of polluted sediments and on the results of behavior, fate and effects of dredged material disposed at the open-water disposal sites.

6 - Formulate plan for a next round of non-degradation cycle of dredging.

28

We sincerely appreciate the opportunity to comments on these documents. We shall be most willing to participate with you and your staff to seek a non-degradation environmental solution to dredging and disposal of polluted sedimnents.

Sincerely yours,

M. Pat Wennekens PhD
Water Quality Chair
Sierra Club - Cascade Chapter

c/o 399 Norman Street
Sequim, WA 98382
(206) 683-4007

Response 28. Extensive opportunities were provided for public participation during the development of the PSDDA management plan (see FEIS Section 6). Future opportunities for public involvement will be provided during the annual reviews and updates of the PSDDA plan. No further public workshops are needed prior to the implementation of the plan.

A response to each of the proposals is given below:

1. Projections were made of future dredging activity based on the best available information. How much of the forecasted volumes that would be considered beyond the minimum to maintain basic marine commerce is difficult to ascertain and largely irrelevant as there is no authority for restricting dredging activity on this basis.

2. The No-Action alternative presumes relevance on the PSIC. This alternative was found not to be in the public interest (see FEIS Section 4).

3. This proposal is not practicable for technical as well as cost reasons. See response No. 4 above.

4. Both the Four-Mile Rock and existing Port Gardner sites are closed. However, the behavior, fate, and effects of open-water disposal of dredged material will be assessed through monitoring of the PSDDA disposal sites (see MPTA, exhibit I).

5. As research is conducted on technology based controls, this information will become available in the published literature. Annual reports will be prepared on the PSDDA monitoring for each of the disposal sites.

6. Annual reviews and updates of the PSDDA management plan are proposed (see MPR chapter 9).

TABLE 2. SUMMARY OF DATA SETS USED IN THIS PROJECT

Study	Number of Stations				
			Bioassay		
	Chemistry	Benthic Infauna	Amphipod	Oyster Larvae	Microtox
Alki Extension	11	11	--	--	--
Commencement Bay	56	54	56	56	50
Duwamish River I	9	--	9	--	--
Duwamish River II	31	--	31	--	--
Eight Bay	48	--	48	--	--
Everett Harbor	6	--	6	--	--
TPPS (Phase III A&B)	29	29	--	--	--
Total	190	94	150	56	50

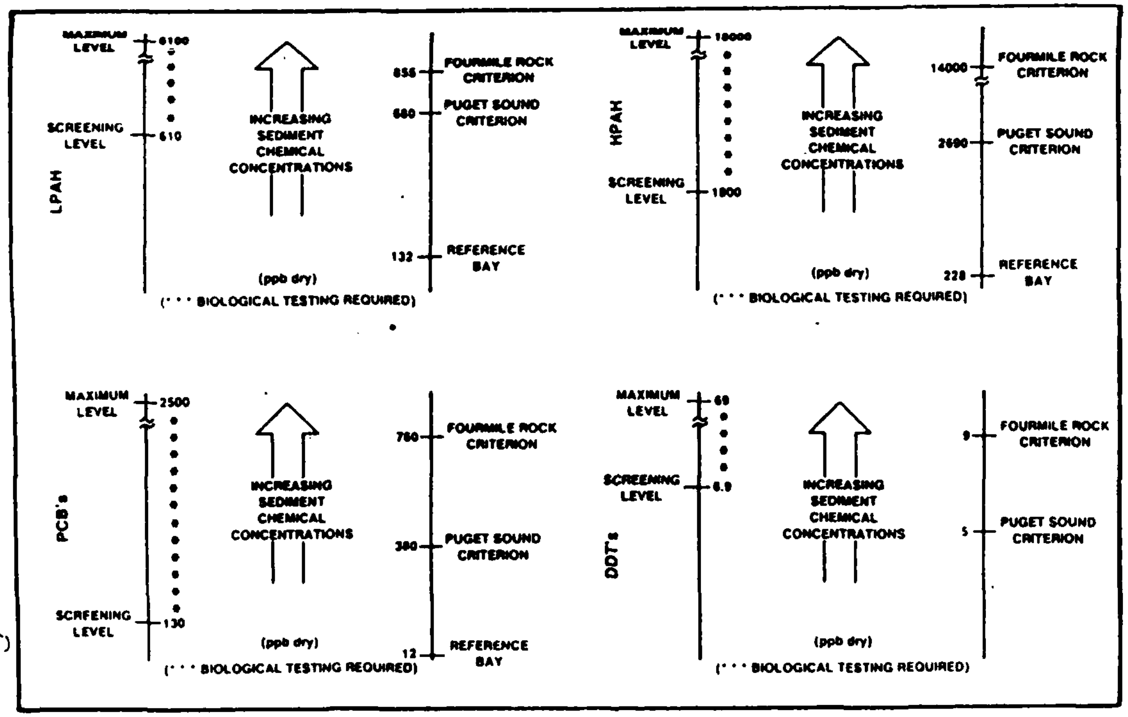

Figure II.11-7 Illustrated example of the differences between interim criteria and proposed PSDDA sediment quality values.

Encl. #2

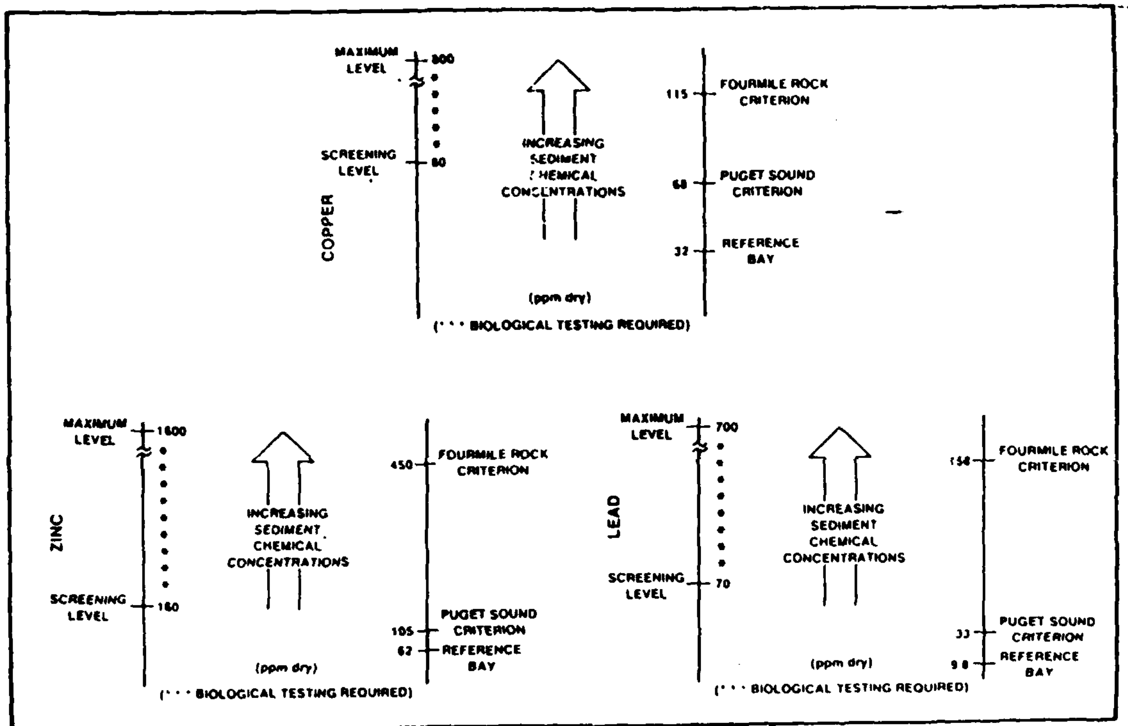

Figure II.11-8 Illustrated example of the differences between interim criteria and proposed PSDDA sediment quality values.

II-208

Encl. #3

PROTECT THE PENINSULA'S FUTURE
P.O. Box 1677, Sequim, Washington, 98382

A non-profit corporation dedicated to the wise land use of the North Olympic Peninsula

February 29, 1988

Frank Urabeck
Seattle District, Corps of ENgineers
P.O. Box C-3755
Seattle,WA 98124

Re: Puget Sound DredgedDisposal Analysis, Jan. '88 Draft Report
and Draft EIS

Dear Mr. Urabeck:

Both of the documents cited above share a single goal: the permissiveness which will allow placement of contaminated dredged sediments in inner Puget Sound.

There isa blatent attempt to finesse the CleanWater Act and Washington State Water Quality Standards and to transcend local shoreline jurisdictions. Non-degradation of water is required by these laws which were written to ensure that one geographic area indeed would not be able to attract an economic advantage over other areas of the country. *Only the no-action alternative comes close to achieving* the purpose of water protection. Please be aware that consumers in California are flocking to grocery stores which test their own produce to assure freedom from toxics. The public , already for some years mistrustful of "expert judgement" in the case of nuclear power, is not likely to be reassured by claims in these documents that should monitoring turn up suspicious results only such an expert can evaluate it, or decide what action to take relative to continuation of disposal in such event (page 7-7). 1

In looking at costs of various alternatives I would urge that the public costs of environmental pollution be added--up front--charged to the disposal cost directly. This should include the costs of PROPER *monitoring, not the partial every 5 year job* proposed which omits biologic assessment after 1991 and omits consideration of carcinogens and numerous other pollutants. 2

By way of specifics:

Page ES-3 and S-3 :"the past practice of discharging untreated or only partially treated industrial and municipal effluent into Puget Sound: Just when did such practices cease? Please list all exceptions to this misleading statement in your Final EIS, giving the locations, approximate volumes and nature of contaminants for the ongoing sources. 3

RESPONSES TO PROTECT THE PENINSULA'S FUTURE 29 FEBRUARY LETTER

Response 1. The PSDDA management plan will improve decisionmaking and management of dredged material and thus Puget Sound water quality and resources. The plan is consistent with the Clean Water Act and Federal Water Quality Standards Regulation. See response Nos. 1 and 5 to the NMFS letter, response No. 2 to the WDF letter and response No. 4 to the DELU letter.

Response 2. The PSDDA plan significantly improves the management of contaminated dredged material and thereby makes a contribution toward reducing the cost of pollution. The disposal site monitoring has been designed to ensure adequate protection of the environment and is very intensive during the initial 5 years of disposal site use. *It is anticipated that after this period,* only spot checking once every 5 years will be needed. All material that will be allowed to be discharged at the sites will have been tested prior to discharge. Also see response No. 10 below.

Response 3. Discharges of effluent and material into waters of the United States have been regulated by the Clean Water Act for more than a decade. More stringent restrictions through Federal and State permits have resulted in environmental improvements. The statements in the Management Plan Report (MPR) (Executive Summary) and FEIS Summary have been modified to recognize that while much has been accomplished there remains more to do.

Response 4. It is unlikely that dredging would completely cease in Puget Sound, even *in the absence of any aquatic disposal sites*. The material dredged would have to go somewhere. It is reasonable to conclude that pressures to fill nearshore sites and wetlands (which often are more economical and practicable than upland sites) will increase. Filling of these sites will still be subject to compliance with the Section 404(b)(1) guidelines. The existence of practicable alternatives is a major factor considered in the Section 404(b)(1) guidelines.

Response 5. The No-Action alternative, which assumes continued use of the Puget Sound interim criteria (PSIC), would result in only an estimated 2.2 million cubic yards of dredged material being found acceptable for unconfined, open-water disposal over the 15-year forecast period (see FEIS table 1d).

Response 6. No capping is required at the *PSDDA disposal sites as* only relatively clean dredged material will be allowed at these sites.

Response 7. In all four cases referenced in the comment, the text is referring to the upper degree of biological effects that would be allowed at the proposed disposal sites, i.e., the "site management condition." Acceptable or unacceptable materials, effects, or "changes" are all measured in terms of whether the effects at the site meet or exceed the preferred condition. In practical terms, acceptable material is defined as sediments that meet the disposal guidelines described in exhibit A of the Management Plan Report (MPR). Acceptable site condition in the field is defined by the monitoring

The not-too-veiled threat that wetlands and nearshore will be used for dredge disposal if open water disposal is restricted to clean materials suggests that another set of laws will be ignored if the Clean Water Act is taken literally. It does not sound like a credible argument, more like environmental blackmail. 4

S-6 and ES-7. How much of the 11.2 million cubic yards of disposal which would be deemed "acceptable" under the new plan would meet the acceptable designation under the present Interim plan ? 5

What monitoring is being done or will be done of capped sites to ensure that the capping stays in place? This is with reference to Northern Tier Pipeline hearings in which migration of the bottom, like moving sand dunes thirty feet high was described. Should a capped area become uncovered what resources (MONEY, AVAILABLE FOR USE) can be tapped to replace the cap or to remove the contaminated sediments? Is it not true that material put at the proposed depths is virtually impossible to retrieve? 6

Some definitions need to be added to the glossary of both documents: 7

"acceptable conditions" (as in ES9, line 7)
"acceptable sediments" (as in ES 8, 4th ¶)
"unacceptable adverse impacts" (as ES9, 6th ¶)
"unacceptable changes" (as on page 7-2, last ¶)

In the EIS Unacceptable adverse biologic effects are well defined by WAC 173-201. In what manner is this a "grey area"? Or: "depends on individual perspective"? 8

Please define "chemicals of concern" (EIS 5-22) and describe how this might go beyond Priority Contaminants. 9

EIS page 5-22: *How can monitoring once a year on a necessarily limited* sample and by rather limited laboratory methods serve "to ensure that there is no acute toxicity to sensitive species onsite and unacceptable effects do not occur outside the disposal site"? What testing is done for carcinogens? radioactives? What happens after 1991? *(no one looking even)* . 10

EIS 2-8: What are the specified criteria for Ocean Dumping (Public Law 92-532)? For both Strait and Ocean dumping the statement is made that there would be no environmental advantage over inner Puget Sound with its confined waters and proximity to shellfish and people. Please explain.. 11

Please define with particularity and quantification the minor adverse effects permissible under Site Condition II (p. 4-5,§ 4). Explain how your plan would detect and control carcinogens (1) on-site organisms and (2) migration of carcinogens and toxics via food chain ot therwise, off-site. 12

No adverse effects were expected over the years from dumping, but look at the results. This is an unacceptable proposal, defined as NO, NO!

Yours truly,

Eloise Kailin, Secretary, PPF

interpretation guidelines provided in exhibit I of the Management Plans Technical Appendix (MPTA) report. To further clarify this issue, a definition of "site management condition" has been added to the glossary.

Response 8. The State water quality standards (WAC 173-201) establish the requirements that must be met by all dredged material disposal activities, pursuant to Federal and State laws. However, while these standards provide detailed requirements for water column effects from dredged material disposal, they do not explicitly address bottom sediment quality. Pursuant to the Clean Water Act, dredged material disposal effects must not result in "unacceptable adverse effects." The guidelines rely on the professional judgment of Federal Corps and EPA regulators for interpretation for local waters. These regulators exercise that judgment in determining what is practicable (which includes costs and logistics) and defining what is less damaging (which includes consideration of upland and nearshore disposal effects). However, the PSDDA study has developed, through an extensive public participation process, very detailed guidance to further assist these regulators and to provide improved consistency in the decisionmaking associated with Federal and State permits.

Response 9. The development of the PSDDA list of chemicals of concern for dredged material in Puget Sound is described in section II-7.1 of the Evaluation Procedures Technical Appendix (EPTA). Many of the chemicals on the PSDDA list are also listed on the EPA "priority pollutants" list. There are a few chemicals on the PSDDA list that are not EPA "priority pollutants," but are nonetheless of concern in Puget Sound sediments. There is also substantial agreement between the PSDDA list and the EPA Region 10 lists of 50 and 100 pollutants of highest priority in the Sound. In essence, the PSDDA list represents those chemicals known to be of concern in Puget Sound sediments. It differs from the other lists that contain chemicals that are not present in the Sound, or are discharged and do not accumulate in sediments. There was no attempt to leave known sediment chemicals of concern off the list.

Response 10. Please see the MPTA exhibit I for a full discussion of the monitoring plan which was developed through extensive involvement of the best available technical expertise, national and regionally. The monitoring will be the most comprehensive of any such program and is designed to verify the prior testing of dredged material placed at the disposal sites and the studies conducted during disposal site selection. Although only accomplished once a year, the extensive check of physical, chemical, and biologial conditions at and in the vicinity of each site is considered sufficient. Suspected carcinogenic compounds, e.g., PCBs, are chemicals of concern for which all dredged material will be tested (see the EPTA). Where there is a reason to believe that radioactive compounds are included in dredged materials at levels of concern, then tests would be conducted for these compounds. Also see response No. 10 above.

Response 11. The *DEIS* and *FEIS* explain that ocean disposal is not a reasonable option for Puget Sound derived material due to high transportation costs; high storm potential, especially during the fall, winter, and early spring seasons; and no offsetting environmental benefits. The preferred PSDDA Phase

I sites were selected from Zones of Siting Feasibility (see Disposal Site Selection Technical Appendix (DSSTA)) that were established, where possible, by employing a 2,500-foot buffer distance from significant biological resources or at least in areas where important resources are below commercially harvestable levels. Also the ZSF's were located in water depths greater than 120 feet, areas generally less productive and of less importance to most of Puget Sound's important commercial fish species. This is discussed in detail in section 2 of the FEIS. The preferred disposal sites are all located in areas relatively free of important biological resources (ZSF). Any ocean disposal sites that would be considered for disposal of Puget Sound dredged material would also have to be located in relatively unproductive areas. Hence, there would be no apparent environmental advantage to disposing at an ocean site versus a Puget Sound PSDDA site. The FEIS discussion of ocean disposal has been expanded (see FEIS section 2.03c(1)).

Response 12. Several of the chemicals identified on the PSDDA chemicals of concern list are known carcinogens (see response No. 10 above). Unless extensive and recent data are available as a basis for characterizing a project area, all material proposed to be discharged at the PSDDA sites would be tested for these chemicals and other toxic compounds (see EPTA, section 3).

In addition, *for* chemicals of human health concern (those carcinogens with available EPA cancer potency values, or noncarcinogens with EPA reference risk dose values), a second concentration guideline was established (see EPTA, table II.6-2). When these chemicals exceed this second guideline, the material will require a 30-day bioaccumulation test using adult clams to determine if the chemicals are available to be taken up by the animal. Interpretation of this test requires analysis of the exposed tissues and comparison to tissue guideline values shown on EPTA, table II.8-5. These comparisons will assist in determining if the material is acceptable for unconfined, open-water disposal.

Following the discharge of dredged material, environmental monitoring will check this material once again with chemical analysis performed for all chemicals on the chemicals of concern list. The tissue of marine animals located in the vicinity of the site will also be checked. (See exhibit I of MPTA for further discussion of the monitoring plan.)

PUGET SOUND ALLIANCE

March 1, 1988

Mr. Frank Urabeck, Project Leader
Puget Sound Dredged Disposal Analysis
Seattle District, Corps of Engineers
Department of the Army
P. O. Box C-3755
Seattle, Washington 98124-2255

Dear Mr. Urabeck:

Attached herewith is the response from the Puget Sound Alliance on the "Proposed Management Plan for Unconfined Open-Water Disposal of Dredged Material, Phase I."

On behalf of the Puget Sound Alliance I commend you and your colleagues in the three other cooperating agencies for one of the more thorough and comprehensive analyses prepared in this area, particularly for Puget Sound.

We were pleased that PSA member, Jim Heil, was able to take part in the advisory group, recommending an open process. As I stated also at the Public Meeting held in Seattle on the Draft Plan, the Puget Sound Alliance in its appeal to the State of Washington Shoreline and Pollution Control Hearings Board, our goal at that time was to have a Puget Sound-wide study undertaken rather than disposal sites continue to be chosen on an ad hoc basis.

Thank you for the opportunity to comment. PSA comments were prepared after an analyses of the proposed plan by several of our members.

Sincerely,

Polly Dyer

Polly Dyer, President

Enclosure

P.O. Box 30843 Seattle, Washington 98103

PUGET SOUND ALLIANCE

March 1, 1988

COMMENTS ON

"PROPOSED MANAGEMENT PLAN FOR UNCONFINED OPEN-WATER DISPOSAL OF DREDGED MATERIAL"

The Draft Report and associated appendices are obviously the culmination of a great deal of thought and effort by representatives of state, local, and federal agencies; environmental groups (as represented by the Puget Sound Alliance); the tribes; and the ports. Given the pressures and political realities, we believe that the draft documents, in general, achieve a reasonable balance between environmental costs and costs imposed on dredging projects, including the management of the resultant spoils. This is not to say that the proposed management plan fully, or even adequately, protects environmental concerns in the Central Sound; but, rather, that it is, philosophically and in most details, as protective as we could expect given offsetting pressures.

Despite this general acceptance of the products of this process, we do have several specific concerns which we believe need to be addressed before the Draft is finalized. These concerns include:

---A need to recognize that despite adherence to the evaluation and management procedures outlined, adverse impacts may occur at the disposal sites which may, in turn, need to be remediated. The reasons for this include, but are not limited to, the following: 1

--Apparent Effects Thresholds (AET) do not account for synergism; 2

--Bioassays do not necessarily predict adverse benthic community effects; 3

--The bioaccumulation exercise in the draft is predicated on some highly speculative assumptions. 4

P.O. Box 30843 Seattle, Washington 98103

RESPONSES TO PSA 1 MARCH 1988 LETTER

Response 1. The PSDDA Management Plan has been designed to ensure that unacceptable adverse effects would not occur, and "safety factors" have been added to the recommended procedures. We recognize that our ability to predict what will occur in the field subsequent to disposal is not exact although research has shown that lab results tend to overstate field conditions. However, to ensure accountability we have established disposal site monitoring plans (described in chapter 7 of the Management Plan Report (MPR) and in exhibit 1 of the Management Plans Technical Appendix (MPTA)) which include interpretation guidelines for determining when the monitoring results suggest the need for taking action. Types of actions are also described in the plan. This commitment to action provides a final assurance that disposal effects will be assessed, verified, and corrected as needed.

Response 2. The Apparent Effects Threshold (AET) values were not the sole basis for the screening level (SL) and maximum level (ML) values used in the PSDDA dredged material evaluation procedures. For a few chemicals, other methods for establishing sediment quality values were adapted which were considered to be more protective. However, the very large data set now available for establishing the AETs does cover a wide range of synergistic effects that are taken into account. No adverse synergistic effects are anticipated below the SL values with biological tests used to check the sediments above SL values.

One of the strengths of the AET approach in relating sediment chemistry to adverse biological effects is that it relies on empirical, field evidence. In deriving sediment quality values from sediments that contained multiple contaminants, interactive effects (especially those that are frequent in their occurrence in the Sound) are "built in" to the results. The more "representative" of Puget Sound that the data base is, the stronger the ability of the AET system to predict adverse effects. This accounts for the strong "performance" of the AET values in correctly predicting the presence or absence of biological effects (see response No. 8 to the Suquamish Tribe letter).

The origin of the AET values also requires a recognition that the chemicals causing the observed adverse effect are not proven or demonstrated by the AET approach (i.e., the AET values provide no definitive "cause and effect" information because the observed effects may have been partially or wholly due to other chemicals in the sediment sample). Nonetheless, the management objective in assessing dredged material is the avoidance of adverse effects, not the determination of which chemicals are causing the effects. The AET approach provides the necessary information for making dredged material disposal decisions.

While anomalies due to low frequency interactions remain a concern when applying the AET values, the PSDDA SL and ML values have been sufficiently buffered to provide a high reliability in predicting the absence of effects (SL values) or the presence of effects (ML).

Given this, we suggest that the final draft clearly recognize the potential for measurable adverse effects in and around the disposal sites, and make a statement of policy with respect to remediating these effects should they occur. Our preference would be that the costs of remediation be borne by those benefiting from the use of public lands and waters for dredge spoil disposal, or passed through to those responsible for the original contamination of the sediments, if possible. If monitoring shows that harmful effects are occurring, then a Stop Order should be issued.

5

It is our understanding that the AETs were based on organic chemistry data which were "recovery corrected" (primarily derived using stable isotope dilution techniques). It is our further understanding the the Puget Sound Estuary Program (PSEP) protocols referenced in the PSSDA documents do not specify recovery correction for organics analysis (although the protocols do allow stable isotope/recovery corrected techniques). We are concerned that the analyses required of dredging projects may thus underestimate the concentrations of specific organics with respect to the AETs. We would like to see this situation rectified.

6

The Elliot Bay disposal site is scheduled to receive the largest amount of dredge spoils; yet, the projected monitoring costs for this site are the lowest of the three proposed sites. The justification for this apparent logical inconsistency is that the area in and around the proposed site is already so contaminated that no reference sites for benthos or benthos body burdens could be established. If one accepts this (slightly shaky) logic, then we would suggest that increased resources be invested in analyzing an increased number of stations for chemistry. With an increased sample size, less substantial increases over "background" (which is already substantially contaminated) could be detected.

7

If the reference chemical and benthic biological stations for the Navy CAD site are taken either very early or very late in the year, they may provide useless reference information. The potential for contamination of the reference sites by disposal at the CAD site is very great. This needs to be remedied.

8

Response 3. Though some correlation between bioassay results in the lab and adverse effects to field benthic communities has been shown, we agree that no predictive inference should be drawn. Protection of benthic communities is provided by four aspects of the PSDDA plan. First, the sites are located away from areas of heavy use by bottom feeding fish and shellfish, and, where possible, in areas which have relatively low benthic infauna abundance and biomass. Second, the SL and ML guidelines were established in consideration of the AET values that were derived based on adverse effects to benthic infaunal communities. (In all cases, the SL values are below and the ML values are at or above, the benthic AET value.) Third, three of the four standard bioassay species that will be used to test dredged material are sensitive marine animals which will act as "surrogates" for other (often less sensitive) benthic species. And fourth, monitoring of the disposal sites will include measurement of the abundance and body burden of benthic species in the vicinity of the disposal sites.

Response 4. We acknowledge that the derivation of the tissue guidelines required extensive development of assumptions for which definitive scientific data are not available. In recognition of these uncertainties, many of the assumptions used by PSDDA were conservative, favoring the protection of human health.

Response 5. Management of the disposal sites will be a continuing process. The planned monitoring data reviews allow for an assessment of the need for a revision of the dredged material evaluation procedures. If unacceptable effects are noted during monitoring, the quality of material allowed for future disposal would be adjusted based on revised evaluation procedures. The new material would serve as a cap for the old material. Remediation of unacceptable effects is addressed in the monitoring plan (see MPTA, exhibit I).

Response 6. There is no current scientific consensus as to the most appropriate method for checking and correcting for recoveries in chemical analysis methods. The issue was debated extensively during development of the Puget Sound protocols. Despite the scientific strengths of the method, there are economic and technical concerns with mandating the use of isotope dilution methods at this time. That is why the continued use of surrogate chemicals was left as an option in the protocols. We recognize that the different methods may produce different results. It has been identified as a key issue during protocols review currently being conducted by EPA.

Response 7. Biological sampling had not been included in the monitoring program for the Elliott Bay site because of the potential difficulty of differentiating impacts of other urban sources from dredged material disposal. Biological sampling has now been added to the baseline monitoring program for Elliott Bay. The amount of biological monitoring conducted beyond the baseline will be based on the amount of biological variation detected during the baseline survey.

Response 8. Baseline reference data collection for both the PSDDA and the Navy sites in Port Gardner was accomplished in May 1988, during the

We believe a valid case could be made for excluding dredged material which exceeds the benthic infaunal AET; or perhaps some modification of this AET. The results of bioassays only predict precisely the response of the bioassay species over the time period of the test. The absence or severe depletion of a taxa of organisms is prima facia evidence of potentially toxic conditions in that sediment which is, in a real sense, more meaningful than the response of test organisms. 9

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biologically preferred spring period. Nine additional PSDDA sediment chemical stations were established between the PSDDA and CAD sites to assure that off-site movement of chemicals from either site can be deflected in this area. Close coordination is being accomplished to minimize the risk for monitoring complications. See response No. 6 to the PSWQA letter. However, if the CAD operation were to impact the PSDDA baseline stations, then the PSDDA stations would need to be "reset" for purpose of monitoring future disposal at the PSDDA site.

Response 9. Protection of benthic infaunal communities was considered. See response No. 3 above. PSDDA agencies are continuing during Phase II of the study to work on development of a cost-effective chronic and sublethal bioassay test. If the ongoing studies are successful, the Phase II results could provide an improved means for assessing long-term effect in sediments. The reason for not relying on the benthic AET values as an absolute, upper value is that natural variability and nonsediment anthropogenic influences (e.g., ship passage, water quality, etc.) can also influence the condition of the benthic community (see section II-6.4.2 of EPTA).

Frank Urabeck, P.E.
Study Director
U.S. Army Corps of Engineers
P.O. Box C 3755
Seattle, WA 98124-2255

February 4, 1988

Dear Mr. Urabeck:

(1) We are very concerned about the U.S. Army Corps of Engineers plans to dump 3.3 million cubic yards of toxic dredgings for the Navy this spring, at three sites: Port Gardner, Elliott Bay and Commencement Bay. There has been little publicity about the public meeting at Federal Central So., 4735 East Marginal Way South, Seattle, at 7:30 p.m. on February 10. We do not want our taxes to support any dumping of harmful materials in Puget Sound.

(2) We have worked hard to bring salmon back into Piper's Creek in Carkeek Park. This fall, a sizable run of cheum salmon returned. The boy scouts who planted them, are so proud. Up and down the Sound similiar projects are happening. Streams are cleaned up, fish eggs planted, and results are anxiously awaited.

What kind of message are the engineers sending to these young and old conservationists? If engineers dump in the Sound this spring, what is to stop every other group from dumping? Isn't it possible to find out who dumped the hazardous materials in the first place. Isn't it their responsibility to clean it up?

(3) If the engineers and all the governmental groups who have OK'd this disaster would use their considerable talents to support the efforts to bring back the fish runs and shellfish, inestimable economic benefits could be realized.

Sincerely yours,

Bob & Janice Miller

Bob & Janice Miller

RESPONSES TO BOB AND JANICE MILLER 4 FEBRUARY LETTER

Response 1. Environmental review, permitting and monitoring of the Navy project is being conducted as a separate activity from PSDDA, although the environmental monitoring portions of both programs are being coordinated. The Corps of Engineers has no plans to dump 3.3 million cubic yards of dredged material from the Navy Homeport project at the PSDDA selected sites. Only acceptable dredged material will be allowed to be discharged at the PSDDA sites. A special site, requiring capping by clean materials, will be used by the Navy for *disposal of contaminated material* at Port Gardner (see FEIS sections 2.03k and 4.13).

Response 2. Comment noted. We share your excitement and pleasure over this salmon run restoration project. The PSDDA management plan is designed to help promote environmental conditions that make projects like this possible. The cleanup of contaminated sediments is being addressed by the Puget Sound Estuary Program and through the leadership of the Puget Sound Water Quality Authority.

Response 3. We certainly support the efforts to bring back fish runs and protect other marine fishery resources. This was one of the reasons PSDDA was undertaken.

am test inc.

14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 206/885-1664

February 10, 1988

U.S. Army Corps of Engineers
Mr. Frant Urabeck, P.E.
Seattle District
P.O. Box C-3755
Seattle, WA 98124

Dear Mr. Urabeck:

Am Test Laboratories has been actively following the PSDDA study. We feel a comprehensive dredging program is a prerequisite for a strong maritime industry in Puget Sound. This program should include cost effective and environmentally sound disposal sites located within reasonable distance to the major dredging locations in Central Puget Sound.

We have closely reviewed the draft report and have found one area which concerns us greatly. Our concern is over the detection *limits listed for* the screening levels for contaminants in the sediment. Am Test was a major contributor to the PSEP protocols for approved analytical methodologies. The screening level detection limits may not be achievable without modifying the protocols.

Specifically, the oxygenated organic compounds (benzyl alcohol, benzoic acid) substituted phenols, and some of the pesticides are the major compounds of concern.

We feel that these detection limits should be reviewed and adjusted to reflect what is actually achievable using the current methodology. Am Test would be willing to participate at no charge in a round-robin study with other local labs to experimentally determine detection limits in a Puget Sound marine sediment matrix.

Sincerely,

Shawn P. Moore

Shawn P. Moore
General Manager

SPM:ja

cc: Keith Phillips
Eric (Weinmann)
John W...

RESPONSE TO AM TEST, INC. 10 FEBRUARY LETTER

Response. It was not the intent of PSDDA to establish screening level (SL) values that were below reasonable analytical detection limits. Consequently, several of the SL values contained in the final report have been adjusted upwards to ensure that detection level issues will be of lesser concern in determining the need for biological testing. Adjustments were made after a review of data contained in Puget Sound data base. EPA is conducting an update of the Puget Sound proto- cols during this year, and is expected to revisit the detection level issues. Your offer to participate in a round-robin study is acknowledged, and has been mentioned to the EPA Office of Puget Sound (responsible for the protocols). In addition, other adjustments may be warranted during annual review of the PSDDA program.

R 2/25/88

JAY W SPEARMAN
CONSULTING ENGINEER

· MARINE
· STRUCTURAL
· ENVIRONMENTAL PERMITS

(206) 822-6021
822-6022
P.O. BOX 2176
KIRKLAND, WASHINGTON 98083-2176

February 22, 1988

Puget Sound Dredged Disposal Analysis
Seattle District, Corps of Engineers
P.O. Box C-2755
Seattle, Washington 98124-2255

Attention: Mr. Frank Urabeck

Gentlemen:

My comments on the PSDDA process and documents are as follows:

1. If it were not for severely depressed activity in the marine industry, the delays associated with implementing PSDDA and approving the new disposal sites would be causing an extreme hardship to local marine businesses.

At this time, projects are being deferred because deep water dumpsites are not available and approved upland disposal sites are both limited in number and prohibitively expensive. New applications for projects with deep water disposal cannot be submitted until the disposal sites are approved. It is possible that the Elliott Bay site will be inoperative for a second year. It is unfortunate that arrangements could not have been made for an interim regional disposal site to remain open until the new sites are operational.

2. Disposal of low contamination problem wastes is a serious matter which is not limited to marine dredging. If material is unsafe to dump offshore, what constitutes a safe upland disposal site, and what should the standards of disposal be? The more one investigates, the larger the knowledge void appears to be.

1

The practical side of the upland disposal issue is that many years will be required to research and develop standards for upland disposal of many marine generated problem wastes. In the meantime, what do we do? A parallel effort should be initiated to develop sites and methods for disposing of contaminated marine spoils which will be generated within the next 5-10 years. The marine industrial community needs a predictable and effective way of disposing of material unsuitable for deep water disposal.

1

4. In the last several years I have been associated with over 50 dredging projects of all sizes and types. While I have followed the PSDDA process closely, my clients have generally taken a passive attitude towards the PSDDA process. Limited time and the specialized nature of the subject matter, have limited their participation and interest. It is my view they support PSDDA's goals.

Greater recognition needs to be given to the public benefits of jobs and economic activity which result from a safe and cost-effective spoil disposal process. The notion that exorbitant costs of disposal are a developer's cost of doing business are likely to be counterproductive. Projects will simply be abandoned or resited. Cleanup is not likely to result. Redevelopment of existing contaminated sites for larger vessels and state of the art materials handling technology should be given priority. Interim cost-effective solutions for disposal of contaminated spoil goes a long way to foster such redevelopment. Redevelopment has the associated side effect of removing existing contamination from the waterways. Development of a means to dispose of problem wastes unsuitable for deep water disposal in the near future is in the public interest and should be given immediate priority.

I am aware of two projects which are currently experiencing difficulties due in part to unavailability of deep water disposal sites.

2

5. I would strongly encourage large projects, particularly publicly funded projects, to provide a means for incorporating contaminated fill from smaller private projects. In the past, one public entity expressed a willingness to accept contaminated spoil, but only at an unrealistically high unit cost.

3

6. Dredging has a measurable, direct impact on employment and economic development. Dredging of formerly industrialized sites which are frequently contaminated, permits economic redevelopment of urban sites. Severe restrictions on disposal of contaminated dredge spoil in conjunction with other factors tend to force development into less developed areas of the Puget Sound basin. Dredging is directly related to economic regeneration of marine related businesses.

Very truly yours,

Jay W. Spearman, Consulting Engineer

JWS/lms
CC: DCLU, Attn: Ms. Meredith Getches
DNR, Attn: Mr. David Jamison

TSC

RESPONSES TO JAY SPEARMAN 22 FEBRUARY LETTER

Response 1. The Department of Ecology is currently undertaking two efforts which will address the issues of disposing of dredged sediments not suitable for in-water unconfined disposal. These efforts are part of the overall Puget Sound Water Quality Plan. One study (element S-4 of the plan) is directed at developing confined sediment disposal standards for inwater (capping), at nearshore sites, and on land. Interim standards are scheduled to be issued by September 1989. The second effort known as element S-6 of the plan is a feasibility and needs study for multiuser confined disposal sites. This study is to be completed by July 1990. The PSDDA agencies recognize the importance of the maritime industry to the State of Washington. We believe that through the implementation of PSDDA and the Puget Sound Water Quality Authorities Plan the needs of the industry will be met while improving the Puget Sound environment. The PSDDA costs are high, but as we move towards cleaning up sources of pollution, the overall program costs should decrease.

Response 2. The S-6 study, cited above, will address various institutional arrangements for meeting the needs for public multiuser confined disposal sites.

Response 3. Comment noted.

I reserve the right to comment on "conflicts of interest," and changes in qualifying criteria.

R 2/21/88

February 29, 1988

Frank Urabeck
Study Director,
Seattle District Corps of Engineers
PO Box C-3755
Seattle, Wa. 98124

Dear ~~Sir~~ Frank:

In pursuit of our mutual happiness, I am obligated to respond to the draft environmental impact statement for the Puget Sound Dredged Disposal Analysis, and the proposed Management Plan. As an owner of Puget Sound submerged land, a recreational beach home, and bulkhead, I too seek the best plan for disposing of dredged industrial waste. It is not, nor has been water disposal. Political awareness initiated our common commitment for a valid and feasible solution to solid waste disposal - the problem. I would prefer it be on private property, but not mine -- to relieve the government from liablity. It is our mutual responsibility to protect, preserve, enhance, and restore Puget Sound. 1

The needs of the Ports to widen and deepen for commerce, and navigation must not supercede our health and aesthetic values ~~in Puget Sound~~. Urbanization need not conflict if ~~we pay our own~~ way. Past disposal violations, investigations, and penalties should be included in an adequate environmental statement. 2

Any disposal criteria (for annual peer review) must be approved by the National Science Advisory Board prior to disposal. 3 Carcinogens, mutagens, and pathogens (COMMUNIC ABLE DISEASE) are accumulating at least ten times more on intertidal beaches than subtidal water. Polycyclic aromatic compounds from anthropogenic combustion comprise the largest class of chemical carcinogens. They represent a potential mutagenic threat to aquatic life as well as to man. 4 PSDDA criteria cannot exceed PAC 100 PPB, nor site background supercede. There must be a 35 day biossay on juvenile salmon because 3 migratory salmon routes are in the proximity of both Elliot Bay sites as monitored by monthly seal routes, and videotaped. 5

PROPOSAL: An elected Health Commission for Environmental Ethics (3 with State licenced medical, 1 Recreational Specialist, and 1 shoreline property owner) to advise... veto. 6

The health departments nearest the proposed public disposal sites for any toxic substance must be the site permitting authority. The City deeded the tidelands to the State for recreational use in 1974. AET should be comparable to EPA'S Safe Drinking Water Goals, but enforceable. NPDES permits must include on shoreline stations. Violations must finance DOE shoreline enforcement, and random sampling of disposal barges. Disposal permit fees must finance Health Dept. data base and monitoring. Failed emission test charges must finance on going water quality research. DNR must restore recreational use to all salt water shorelines, and monitored by PSWQA. EPA must declare the inter and sub tidal beach a Superfund site from Pier 90 to Discovery Park, or have Metro, Port, ~~and COE~~ provide a "Goodwill Games" type pool in Magnolia. 7

Sincerely,

Bonnie

Bonnie Orme [illegible]

C-111

Existing ~~Standard~~ Would you set P.S. Swimming standards (goals) with this info.? AET help me.

MICROBIOLOGICAL CONTAMINANTS

Microbiological organisms were the first drinking water contaminants to arouse concern. The first federal standards to control these "microbials" date back to 1914. Cholera has been under control in this country since the 1870s, and typhoid since about 1920. Two types of microbial-related contaminants are now subject to regulation under the Safe Drinking Water Act.

Interim Maximum Contaminant Levels in Force:	Principal Health Effects:
Total Coliforms (Coliform bacteria, fecal coliform, streptococcal, and other bacteria)	Although not necessarily in themselves disease-producing organisms, coliforms can be indicators of organisms that cause assorted gastro-enteric infections, dysentery, hepatitis, typhoid fever, cholera, and other diseases of surface water; also interferes with the disinfection process

INORGANIC CHEMICALS

Most inorganic chemicals, such as arsenic and fluoride, are present naturally in water from geological sources. Others, such as lead, enter the water as the result of human intervention.

Interim MCLs In Force For:	Principal Health Effects.
Arsenic	Dermal and nervous system toxicity effects
Barium	Circulatory system effects
Cadmium	Kidney effects
Chromium	Liver/kidney effects
Lead	Central and peripheral nervous system damage; kidney effects; highly toxic to infants and pregnant women
Mercury	Central nervous system disorders, kidney effects
Nitrate and Nitrite	Methemoglobinemia ("Blue-Baby Syndrome")
Selenium	Gastro-intestinal effects
Silver	Skin discoloration (Argyria)

Final Revised MCL In Force For:	Principal Health Effects.
Fluoride	Skeletal damage

ORGANIC CHEMICALS

The organic chemicals listed here—except trihalomethanes, a chlorination by-product—fall into two main categories: synthetic organic chemicals (SOCs) and volatile synthetic organic chemicals (VOCs). In scientific terms, "volatile" means capable of being readily vaporized, evaporating readily at normal temperatures.

Synthetic Organic Chemicals

SOCs are synthetic organic compounds used in the manufacture of a wide variety of agricultural and industrial products. The best-known SOCs are pesticides and herbicides.

Interim MCLs In Force For:	Principal Health Effects.
Endrin	Nervous system/kidney effects
Lindane	Nervous system/liver effects
Methoxychlor	Nervous system/kidney effects
2,4-D	Liver/kidney Effects
2,4,5-TP Silvex	Liver/kidney effects
Toxaphene	Cancer risk

Volatile Organic Chemicals

VOCs are a broad class of synthetic chemicals used commercially as degreasing agents, paint thinners, varnishes, glues, dyes, and pesticides. They are most commonly used in urban industrial areas, where they can contaminate ground water if improperly disposed.

No interim MCLs are yet in force for VOCs, but RMCLs (now known as MCL Goals) have been promulgated and MCLs have been proposed.

Other Organics (Disinfection By-Products):

Interim MCLs In Force For:	Principal Health Effects
4 Types of Trihalomethanes	Cancer risk

RADIONUCLIDES

Radionuclides are radioactive compounds sometimes found in drinking water. Radionuclides get into drinking water drawn from ground-water wells. On occasion, these wells can become contaminated by uranium and radon deposits that occur naturally in the soil of various regions. In a few cases, man-made radionuclides—from radioactive waste—can be the source of contamination. Like other drinking water contaminants, radionuclides pose a threat to human health when ingested.

Interim MCLs In Force For.	Principal Health Effects
Gross alpha particle activity	Cancer
Beta particle and photon radioactivity from man-made radionuclides	Cancer
Radium-226	Bone cancer
Radium-228	Bone cancer

MISCELLANEOUS

Monitoring Regulations In Force For:	Health Effects
Sodium monitoring and reporting	Hypertension
Monitoring of distribution systems for corrosion and other problems	Lead poisoning and other problems

SECONDARY

Non-enforceable secondary standards exist for the following:

Contaminant:	Effects.
pH	Water should not be too acidic or too basic; must fall between 6.5 and 8.5 on the pH scale
Chloride	Taste; corrosion of pipes
Copper	Taste, staining of porcelain
Foaming agents	Aesthetic
Sulfate	Taste and laxative effects
Total dissolved solids (Hardness)	Taste; possible relation between low hardness and cardiovascular disease. Also an indicator of corrosivity (lead problems); can damage plumbing and limit effectiveness of soaps and detergents
Zinc	Taste
Fluoride	Dental fluorosis (A brownish discoloration of the teeth)
Color	Aesthetic, consumers turn to alternative supplies
Corrosivity	Aesthetic, also health related
Iron	Taste
Manganese	Taste
Odor	Aesthetic

RESPONSES TO BONNIE ORME 29 FEBRUARY LETTER

Response 1. Your position regarding inwater disposal of dredged material is noted. Federal and State law recognize the need for dredging and dredged material disposal to maintain our navigation waterways. Dredged material that will not result in unacceptable adverse effects to the aquatic environment is allowable for disposal at properly designated and managed sites. PSDDA management plan has been designed with these considerations and requirements in mind.

The 1987 Puget Sound Water Quality Management Plan recognized that dredging and dredged material disposal contributed to achieving the intended cleanup of the Sound by placing the more contaminated materials that are dredged in confined disposal sites with the cleaner materials discharge in well located, well managed unconfined sites. As such, the plan recognized that some effects at the unconfined sites may be acceptable until source control is effective.

Response 2. Compliance requirements, violations, corrective actions, and penalties in the use of the PSDDA disposal sites were thoroughly considered during the study. The PSDDA recommendations regarding these topics are outlined in the Management Plans Technical Appendix (MPTA).

Response 3. The PSDDA evaluation procedures have received input and review from many regional scientists (including individuals with recognized national expertise). The recommended procedures are generally accepted for application in Puget Sound and are being applied in other programs, e.g., Puget Sound Estuary Program.

Response 4. The SL and ML guidelines for polynuclear aromatic hydrocarbons was established using chemical data, biological tests, and test species from Puget Sound. The resulting guidelines are considered appropriate for protection of the Sound.

Response 5. Past testing conducted with juvenile salmon has shown them to be less sensitive to sediment exposures than other available test species. Part of the reason for this is likely due to a less direct contact with the sediments than for other species.

Response 6. The protection of human health was considered by PSDDA in developing the bioaccumulation test and test interpretation guidelines. These are described in section II-8.4 of EPTA. Given the location of the proposed sites, the testing and compliance requirements for their use, and the follow-up environmental monitoring, no adverse effects to human health are anticipated.

Response 7. Your concerns regarding shoreline impacts of dredged material disposal are acknowledged. However, adverse effects to shorelines from the authorized use of the PSDDA sites are not anticipated (see response to previous comment). Even though NPDES requirements, Health Board funding, Superfund site designation, and replacement of recreational shorelines with swimming pools are not within the purview of the PSDDA study, they are not considered to be necessary from solely a dredging consideration.

Washington Environmental Council

4516 University Way N.E.
Seattle, Washington 98105
206-547-2738

TO: Mr. Frank Urabeck, Director
Puget Sound Dredged Disposal Analysis Study
U.S. Army Corps of Engineers, Seattle District
P.O. Box C-3755
Seattle, WA 98124-2255

DATE: March 7, 1988

SUBJECT: Comments on Proposed Management Plan for Unconfined Open-Water Disposal of Dredged Material In Central Puget Sound (5 volumes: January 1988)
Draft Report: Proposed Management Plan (DPMP)
Draft Appendix: Evaluation Procedures (DEP)
Draft Appendix: Disposal Site Selection (DDSS)
Draft Appendix: Management Plans (DMPs)
Draft Environmental Impact Statement (DEIS)

The Washington Environmental Council has reviewed the above-mentioned reports. We are deeply concerned about their *inconsistencies* with established water quality standards and their non-compliance with the planned goal, the long-term goal and the Puget Sound water quality plan of the Puget Sound Water Quality Authority (December 17, 1986).

G E N E R A L   C O M M E N T S

Sediment Criteria: AET basis unvalidated and unacceptable

The precision and accuracy of the data generated by Tetra Tech, Inc. in support of their Apparent Effects Threshold (AET) theory is highly suspect because of their use of unvalidated analytical methods. Those methods have never been validated by the U.S. Environmental Protection Agency (EPA) Region 10 Quality Assurance Office, nor have they ever received peer review. These facts are extremely alarming because all the proposed sediment criteria are based on the AET theory. That is, the basic rationale for the proposed "PSDDA Sediment Criteria" has never achieved scientific acceptability. We can only conclude that PSDDA's improper acceptance of AET as a valid theory is the result of either gross error or deliberate deception. 1

Sediment Criteria: EP approach viable and acceptable

In profound contrast to the inadequate AET is the Equilibrium Partitioning (EP) approach to establishing sediment criteria, which is currently supported by the EPA Criteria and Standards Division (see references below) and is scheduled for an EPA Science Advisory Board review this year (preliminary presentation, June 1988; final presentation, September 1988). 2

RESPONSE TO W. ART NOBLE 7 MARCH 1988 LETTER

While Mr. W. Art Noble transmitted his comments under the letterhead of the Washington Environmental Council (WEC), the PSDDA agencies were subsequently advised that although his comments did not necessarily reflect the views of WEC, they should be considered. Accordingly, Mr. Noble's comments have been included in the private individuals/companies comment/response section.

A meeting was held on April 16, 1988 with Mr. Noble to discuss his concerns and comments. Representatives from all four of the PSDDA agencies participated in that meeting which was held at the office of EPA Region 10.

Response 1. Though PSDDA did not rely solely on the Apparent Effects Threshold (AET) values to develop the proposed SL and ML guidelines, completed and ongoing scientific review of the AET method and values is resulting in increasing recognition of the applied strengths and management utility of the AET approach to the development of sediment quality values. The PSDDA evaluation procedures have received input and review from many regional scientists (including individuals with recognized national expertise). The recommended procedures are considered peer reviewed and accepted for application in Puget Sound. Further, since most of the PSDDA procedures are founded in the Puget Sound Estuary Program (PSEP) Puget Sound Protocols, review and acceptance afforded to the protocols provides added support to their use as standard methods for Puget Sound sediment assessments. These consensus protocols have been thoroughly reviewed by regional experts in Government, academia, and consulting fields, both from technical and policy perspectives.

During development of the SL and ML values, the AET values were tested to determine their ability to correctly predict toxicity in the Puget Sound data base. The reliability of SL and ML values were also tested on several case projects. Testing of the SL and ML values with the recently expanded Puget Sound data base has also been accomplished. In all cases, the tests have shown the SL and ML values to be reliable predictors of adverse effects. The SL values have been shown to be environmentally sensitive and the ML values have been shown to be cost effective.

The AET methodology will be presented to the EPA Science Advisory Board this coming summer. Further discussion concerning the scientific acceptance and validity of the AET concept, and the relationship of the AET values to the proposed PSDDA SL and ML values, has been added to the text in section II.7-3 and II.7-4 of the Evaluation Procedures Technical Appendix (EPTA).

Response 2. The use of sediment quality values derived from the equilibrium partitioning (EP) approach was considered in detail during the PSDDA/PSEP sediment quality value study. The numbers derived during that study were, for most chemicals, substantially higher in concentration than those derived by other methods. When applied to available field data, the EP values resulted in high efficiency (sediments with concentrations above the values were indeed toxic), but very low sensitivity (there were many toxic stations that were not

(2)

The EP approach measures the contaminant concentration in interstitial water (i.e., water in the spaces between bottom sediment particles), which has been found to be similar to that in the adjacent water column, and it increases in direct proportion to the concentration of organic carbon in the sediment. Thus, existing water quality criteria are not only relevant, but directly applicable to sediment criteria. Any attempt to set sediment criteria in isolation from their aquatic context is blind; the already established criteria for water quality provide the only valid point of departure for setting the ones for sediments. Furthermore, levels established for sediment chemicals not presently used in water column analyses must anticipate such a use.

A detailed description and further information on the EP approach may be found in:

Evaluation of the Equilibrium Partitioning Theory for Estimating the Toxicity of the Nonpolar Organic Compound DDT to the Sediment Dwelling Amphipod *Rhepoxynius abronius*. Work Assignment 56, Task 1, prepared by J. Q. Word, J. A. Ward, L. M. Franklin, V. I. Cullinan and S. L. Kiesser, Battelle Marine Research Laboratory, Sequim Washington for the U. S. Environmental Protection Agency, Criteria and Standards Division, Washington, D. C., December 1987.

Reconnaissance Field Study for Verification of Equilibrium Partitioning Nonpolar Hydrophobic Organic Chemicals. Work Assignment 77, Task 13, prepared by R. D. Kadeg and S. P. Pavlou, Envirosphere Company, Bellevue, Washington, for the U. S. Environmental Protection Agency, Criteria and Standards Division, Washington, D. C., November 1987

Sediment Criteria Methodology Validation: Uncertainty Analysis of Sediment Normalization Theory. Work Assignment 56, Task 3, prepared by S. P. Pavlou, R. D. Kadeg, A. Turner and M. Marchlik, Envirosphere Company, Bellevue, Washington, for the U. S. Environmental Protection Agency, Criteria and Standards Division, Washington, D. C., January 1987.

Elaboration of Sediment Normalization Theory for Nonpolar Hydrophobic Organic Chemicals. Work Assignment 37, Task 2, prepared by R. D. Kadeg, S. P. Pavlou and A. S. Duxbury, Envirosphere Company, Bellevue, Washington for the U. S. Environmental Protection Agency, Criteria and Standards Division, Washington, D. C., January 1986.

Initial Evaluation of Alternatives for Development of Sediment Related Criteria for Toxic Contaminants in Marine Waters (Puget Sound) Phase II: Development and Testing of the Sediment Water Equilibrium Partitioning Approach. Prepared by S. P. Pavlou and D. P. Weston, JRB Associates, Bellevue, Washington, 1984.

Alarming exclusions of chemical contaminants that must be measured and arbitrary augmentation of "allowable" contaminant levels:

PSDDA has used a three-stage exclusion process to drastically reduce their responsibility to screen for chemicals of concern and, at the same time, has

(3)

identified by the EP values). However, some of the PSDDA SL and ML values are based on the EP approach rather than the AET approach (see EPTA, section II). Ongoing work in this field may produce new values to consider in the near future. If found to be more reliable at predicting toxicity than those now based on AET values, the new values would likely be recommended for use during the annual review of the PSDDA procedures. There was no a priori decision to utilize one particular theory or method over another, but rather to develop chemical disposal guidelines that were sufficiently reliable (when tested against what was known to be or not to be toxic) to warrant their use to facilitate management decisions.

Response 3. See response No. 9 to Protect the Peninsula's Future letter.

Chlorinated dioxins and furans (e.g., 2, 3, 7, 8-Tetrachlorodibenzo-p-dioxin (TCDD) are not currently included on the PSDDA list of chemicals of concern. Some of the reasons for this are provided in section II-7.1.2 of EPTA. As indicated, further study is needed with these chemical groups before a decision is made to add them to the routine chemicals of concern list. The distribution and potential effects of these chemicals in Puget Sound sediments needs consideration, and analytical methods and local laboratory capabilities need developing, before they can be added to the regulatory testing requirements for dredging projects.

Also see response No. 17 to the NMFS letter regarding TCDD.

The historic practice of measuring oil and grease concentrations in dredged material was refined by substituting direct measurement of those chemical compounds of concern found in petroleum and combustion products. Consequently, the PSDDA list of chemicals of concern includes 16 polynuclear aromatic hydrocarbons (PAH's). Measurement of oil and grease does not identify the presence or quantify the concentration of these priority pollutant chemicals. Oil and grease measurement will not distinguish between products of petroleum origin and oils from other natural sources. In addition, the fraction of oil and grease that is available to be released to the water column and the sea surface cannot be predicted from a total oil and grease analysis. Oil and grease found in bottom sediments is considered to be substantively in a form that is not readily available for dispersal. It is often associated with particles that will settle, and it has been processed to some degree during settling. Mechanically dredged material, released in a single dumping action from a bottom release barge, will also minimize the disturbance of the material and the release of oil fractions. For these reasons the measurement of oil and grease in material to be dredged is considered to be a relatively general indicator that does not directly contribute to an assessment of the potential effects of dredged material disposal. Though the analysis of PAH's is considerably more expensive, the information can be related to possible adverse biological effects of material disposal. Discussion of dredged material disposal effects on the sea surface microlayer is provided in section II-2.3.3 of EPTA.

Response 4. Please refer to previous response concerning chemicals of concern not presently on the PSDDA list. With the PSDDA proposed evaluation procedures, environmental protection is embodied in the SL values. Above the SL

(3)

augmented allowable levels of the remaining chemicals to shockingly high concentrations, some of them orders of magnitude above the levels previously established for Puget Sound.

This systematic reduction/augmentation begins with the "(PSDDA) Chemicals of Concern." We view the exclusion of specific chemicals from this list as a denial of the accumulated scientific evidence identifying major chemicals of concern in aquatic environments and as a subversion of the progress made by state and federal agencies in water quality control. The most glaring exclusion is that of chlorinated dioxin, the most toxic substance ever tested by EPA, which accumulates and remains in sediments for decades. Contrary to the PSDDA claim, the presence of dioxin has been verified in the fish of Puget Sound. Recent primate tests indicate adverse reproductive effects at 0.000 000 000 001 gram per kilogram of body weight; recent trout tests showed lethality at concentrations of 38;1 000 000 000 000 000. Chlorinated dioxins and furans --their homologues and isomers--must be included in the PSDDA chemicals of concern and PSDDA screening/analysis lists.

Oil and grease (lipids) are contaminants of grave concern which must be included in the PSDDA sediment screening/chemical analysis-action lists in the required evaluation of dredged material. Lipids are solvent to 92 (i.e., 71%) of the 129 EPA Priority Pollutants, so they provide a major contaminant concentration medium. Oil and grease also provide a transport mechanism of the concentrated pollutants onto the shorelines and beaches of the Sound. Due to positive buoyancy, the oil and grease from sediments dislodged by dredging and disposal operations rise to the sea surface microlayer (SSM) and are driven by wind and waves to the shore, where they pose a direct threat to human health.

During its floatation period, the oil and grease fraction transforms the SSM that it travels through (i.e., the obligate living space of the larval stages of many valuable species, such as Dungeness crab) into a lethal zone.
[Page II-81, Table II.7-1, "(PSDDA) Chemicals of Concern," DPMP]

(4)

The reduction/augmentation continues in the tables of Screening and Maximum levels (chemical analysis action levels). Dioxin, oil and grease are excluded from these tables as well as nine of the PSDDA chemicals of concern. Many of those included show "allowable" limits that are unconscionably high: metals, HPAHs, and chlorinated hydrocarbons, among others. Serious pollutants which lack any maximum level include a chlorinated benzene, the phthalates, pentachlorophenol and broad-spectrum insecticides.
[Pages A-14 and A-15, Table A.7, "Screening Level (SL) and Maximum Level (ML) Guideline Chemistry Values (Dry Weight Normalized," DPMP]; [Pages II-115 to II-118, Table II.8-4, "Screening and Maximum Level Chemistry Values: January 1988 rev.," DEP]

(5)

We next find another reduction of the list in the table of concentration of toxic substances allowed in human tissue, (i.e., the PSDDA-permitted human body burdens of substances that are a threat to human health). The

values, biological testing is necessary. The proposed SL values are very reliable (highly sensitive), relatively low (usually near reference area concentrations), and conservative (biased to biological testing) values which are considered good indicators of the absence of effects of concern. All chemicals on the PSDDA list have SL values, above which biological testing is needed for a decision on unconfined, open-water disposal.

For some chemicals of concern, it is currently not possible to define a technically defensible ML value, as predictions of "assured toxicity" are not reliable with the current data base. For those chemicals, it will be necessary to continue reliance on biological testing for now.

Response 5. The list of chemicals of human health concern in Puget Sound dredged material was limited to those for which there are available EPA cancer potency values (for carcinogens) or reference risk doses (for noncarcinogens). As indicated in section II-8.3 and II-8.4 of EPTA, there is only limited concern for many of these chemicals, as current data suggest that they are not likely to reach the established risk levels. However, they were retained on the human health list and will be considered until additional study and information are available.

The tissue guidelines were developed using very conservative risk assessment and exposure assumptions. These included:

a. an assumption that all fish consumed by shoreline recreational activities were derived from the flatfish home range that overlapped the proposed disposal site,

b. an assumption that the site was completely covered with the material that was being tested for an indefinite period after disposal,

c. an assumption that a person would consume bottomfish from the disposal site every day for 70 years, and

d. an assumption that laboratory tissue test results on clams would be equaled in all fish in the field (proportional to the disposal site/home range area). No decreases due to metabolism or cooking were assumed.

With these (and other assumptions outlined in EPTA), an added factor of bioconcentration and/or biomagnification was not considered necessary for adequate protection.

Response 6. Chemical tests and bioassays will be conducted on sediments sampled from the disposal site because it is anticipated that the physical impacts of disposal will dramatically alter the resident benthic community there. These measurements will be used to verify onsite conditions. Chemical measurements at the perimeter line and biological measurements elsewhere offsite will be used to detect offsite movement of chemicals. A check of benthic infaunal communities at offsite biological stations will also be done as will chemical tissue analyses.

(5)

chemicals on this list--again reduced from the previous one--were computed on the consumption of fish only...no shellfish...and in the fish contamination only at the level of the sediment concentration. No bioaccumulation was factored in. This unscientific approach and continual decrease in attention to known toxins is an affront to the public.

[Page A-24, Table A.9, "Target Tissue Concentration Values for Chemicals of Concern for Human Health," DPMP]; [Pages II-121 and II-122, Table II.85, "Resulting Target Tissue Concentration Values (HI) for Chemicals of Concern to Human Health," DEP]

As already stated, concentration of toxic substances in sediments that require bioaccumulation tests is too abbreviated. Many of the chemicals are listed with action levels absurdly high. We find no rational basis for these assigned values.

[Page A-19, Table A.8, "Sediment Chemistry Guideline Values for Bio-accumulation," DPMP]

(6)

Incomplete analytical monitoring approach:

The proposal to make chemical and biological monitoring mutually exclusive is unacceptable. Competent monitoring evaluation and decision-making depend on dual biological-chemical analyses as the two, inextricable components of all water quality programs of any value.

(7)

Attempt to tamper with Lethal Concentration (LC) international scientific unit of measure:

Acute toxicity is determined by bioassay, the end point of which records a catastrophic event: It is the concentration which kills 50% (LC_{50}) of the organisms present in a specified length of time. This is a globally accepted unit of measure, the value of which cannot be reassigned (i.e., LC_{50} to LC_{60}) at will. Furthermore, the imposition on acute toxicity of qualifiers such as "minor" is offensive and calls into question the scientific integriby of the document as a whole.

The term "Site Condition II" is equivalent to PSDDA's preferred Maximum Level 2 (ML2). Under Site Condition II, we read, "minor acute toxicity," "no severe acute toxicity," and "no significant acute toxicity," phrases which mock the scientific standard: acute toxic conditions are never minor, always severe, and always significant.

Site Condition II (ML2) allows 60% lethal concentrations (LC60) [see page II-206, Figure II.II-4, DEP]. These value judgments claiming only minor or nonsignificant effects lull the reader into a false complacency by hiding the true impacts of a 60% kill factor.

(8)

In addition to the above, the meaning of "maximum level" is further abrogated by the fact that, if a single chemical exceeds the maximum level,

Response 7. The identification and use of LC50 or EC 50 concentrations is a widely recognized measure when addressing water column and water quality concerns. These measures are especially important when considering mixing of chemical contaminants in water. It is this dilution that results in varying concentrations over time, and the need to specify acceptable concentrations of chemicals in water. However, this dilution perspective does not directly apply to the sediments. The concentration of sediment chemicals of concern, or the fraction of the whole sediment, that causes a percent mortality in the test population is not being calculated. Dose response bioassays (which would be needed to conduct this type of assessment) are not required. The PSDDA bioassays are conducted using whole sediment and comparing animal survival with that achieved with control and reference sediments. No dilution is allowed.

In defining the preferred site management condition (SC-II) it was necessary to proceed from "conceptual" and "qualitative" field definitions to "quantitative" definitions in the laboratory. "Minor" adverse effects in the field was accepted as the preferred goal, as this was consistent with Section 404(b)(1) guidelines. It is recognized that the laboratory will usually overstate field effects. Historically, the difficult predictive leap from laboratory to field effects has been accomplished through individual professional judgment. This has led to some inconsistency in the technical decision process. PSDDA agencies have provided more specific guidance in the interpretation of laboratory tests than was available at the time the study began. The PSDDA evaluation procedures will be checked through environmental monitoring (see response No. 10 below).

PSDDA's SC-II is not "equivalent to PSDDA's preferred ML-2." The ML-2 chemical values are concentrations above which the sediments are not expected to be found acceptable for unconfined, open-water disposal. Concentrations less than ML-2 values (but above SL values) are not acceptable without passing the biological tests. The suite of biological tests described in the PSDDA documents is applied to sediments that have chemical concentrations greater than the SL values and less than ML values. When two or more chemicals are significantly above the ML values, or one chemical is greater than 100 percent above the ML value, additional biological testing is required. This would include not only the standard battery of biological tests but additional tests that would be defined on a case by case basis by the regulating agencies.

Concerning acceptable toxicity in the whole sediments, PSDDA agencies did consider use of the more recognized "50 percent" guideline, but concluded that it represented toxicity that exceeded the intended goal of no more than "minor" adverse effects. The PSDDA biological disposal guidelines define "minor" as no more than two bioassays showing a statistically significant response relative to reference sediment results, or no more than 30 percent increased mortality above reference for any one bioassay species (other than microtox). The only time that dredged material mortality near "60 percent" would be acceptable would be when:

a. only one of the four test species (other than microtox) show a statistically significant result relative to reference sediment results,

8

it must do so by more than 100% before biological testing is required.

In these reports, changes of meaning and measure abuse "acute toxicity," and qualifiers confute "maximum level."

Deficiency in proposed toxicity testing:

As proposed, toxicity data are limited to acute and bioaccumulation tests; they measure only catastrophic events, not slow, wasting deaths, adverse reproductive effects, deformations in development, etc. (i.e., chronic toxicity).

The amphipod bioassay has limited application in toxic measurement of dredged material. Amphipods (*Rhepoxynius abronius*) are poor subjects for testing the fine-grained sediments that normally constitute dredge spoils. The natural amphipod environment is larger-grained sand. Dredged, fine-grained particles frequently interfere with test results, thus producing measurements of reaction to particle size rather than chemical substance.

Pitifully few marine indicator species are proposed for acute toxic and bioaccumulation measurements. Different species have different enzyme systems which respond to the same chemicals differently (e.g., metabolize to an innocuous form or metabolize to a more toxic form). There is thus great danger in relying on the few species proposed to represent effects on the aquatic biota.

Moreover, different marine organisms assimilate substances by different routes (e.g., filtering particles out of the water column, feeding on organic matter in bottom sediments or preying on organisms which have already accumulated contaminants in their tissues.)

An adequate battery assay test must include representatives from these various groups (e.g., burrowing shrimp, polychaete worms, sea cucumbers, crabs and fish).

9

The monitoring program is vague, undefined and incomplete

None of the reference sites are within the PSDDA-designated Central Puget Sound Area. Any comparisons are thus invalid. The Sound must have its own reference sites. Each reference site must consist of a cluster of sampling stations producing a cluster of data points comparable to the cluster of data points in the proposed disposal sites. They must be located with the same care as was used in the selection of the dumpsites.

It further must be understood that these Central Puget Sound reference sites exist as already polluted to approximately one order of magnitude above historical (early 1900s) levels.

b. the control sediment results are at the maximum acceptable mortality level of 10 percent (indicating that the test animals are experiencing some mortality due to population and/or laboratory conditions),

c. the reference sediment results are at the maximum acceptable mortality level of 20 percent above control, i.e., 30 percent (indicating that the one test species is responding to fine-grained sediments), and

d. the dredged material results are at an additional 30 percent above the reference result (i.e., 30 percent in the reference and up to 60 percent in the dredged material).

The conclusion drawn from this (very unlikely scenario) is that the 60 percent dredged material result for this one species consists of 10 percent animal condition, 20 percent response to fine-grained materials, and 30 percent response to sediment chemicals of concern. This case would not exceed the laboratory definition of "minor adverse effects" due to chemicals of concern in the dredged material.

In summary, PSDDA provided the necessary and specific definitions for the degree of biological effects that would be considered acceptable at the site, and embodied those definitions in the preferred site management condition.

Response 8. See response No. 12 to the Puyallup Tribe letter.

We recognize that fine-grained sediments can contribute to the mortality response in the amphipod test. That is why a reference sediment of similar grain size will always be run concurrent with the dredged material tests. The disposal guidelines are keyed to the reference sediment results.

Response 9. True, the reference sites currently identified for the Phase I area are all located in the embayments of the Phase II area (see EPTA table II.6-1). However, some other locations have been suggested which are contained in the Phase I embayments (Port Susan). The boundaries separating the Phase I and II areas were established on the basis of convenience rather than on the basis of vast differences in marine environments as resources were not available to begin study of the entire Puget Sound region all at once. Accordingly, the reference areas are usable for testing of both Phase I and II dredged materials. Reference areas are locations free of chemical pollution that can be used in dredged material testing to factor out bioassay animal responses that are due to grain size rather than chemicals of concern (see response No. 7 above).

Response 10. The purpose of offsite biological monitoring is to detect offsite movement of chemicals (see response No. 6 above). Enough information should be available to determine whether further monitoring of the benthos is warranted, after two full monitoring studies have been conducted over the initial 5 years of site use. The number of stations is specified in the Management Plans Technical Appendix (MPTA) and all stations were accurately positioned prior to initiating the baseline studies.

As proposed, biological monitoring following the baseline tests is nearly excluded from the 15-year plan. Only two biological monitoring visits are scheduled for the three DNR disposal sites (e.g., in Elliott Bay, only one visit in 1989 and one in 1991 are designated, but no further biological monitoring is planned for the remaining 12 years of the so-called 15-year schedule).

This cannot be called a monitoring plan. (10)

Although the report talks about chemical and biological sampling of the dumpsites themselves, the number and locations of those sites have not been specified. The same thing was promised--but not specified--for the present Four Mile Rock dumpsite, which now sprawls over five square nautical miles. It never happened, and now we are told that the biological effects will never be looked at.

Both dumpsite and reference site sampling stations must be located before the proposal is accepted.

PSDDA's proposed Port Gardner Disposal Site is unacceptable:

1) It is too close to the proposed Navy RADCAD disposal site (i.e., 860 feet from their proposed "capped" toxic waste dumpsite. See next page.) Disposal at the proposed PSDDA site would contaminate the capping layer of the Navy site and skew their monitoring data.

2) It is adjacent to the "crab condo" of Port Gardner Bay, the densest reproducing crab population known to exist in Puget Sound. The dumping of spoils at the proposed Port Gardner site would adversely affect this valuable resource. (11)

3) It is located in an important sport, commercial and tribal fishing area.

Given the clear disadvantages of the PortGardner Site, the Saratoga Passage Disposal Site (see page II-211, Figure II.10-3, DSS) becomes the only viable site alternative.

Failure to fulfill National Environmental Policy Act (NEPA) requirement:

The DEIS does not include a "worst case analysis," which is required by federal law and which requirement has been upheld in the Ninth Circuit Court of Appeals. (12)

W. Arthur Noble

W. Arthur Noble
Coast and Shorelines Committee

attachment: Detailed comments

Biological sampling and analysis will not be triggered until sufficient material has been placed at the site (or after 3 years) to ensure that if there is a biological response its relationship to disposal site use can be established, given the natural variation in the benthos. Biological testing will be performed after 45,000 cubic yards are placed at the site (see MPTA, exhibit I). This volume represents the lowest average annual volume placed at any of the Phase I sites between 1970 and 1985.

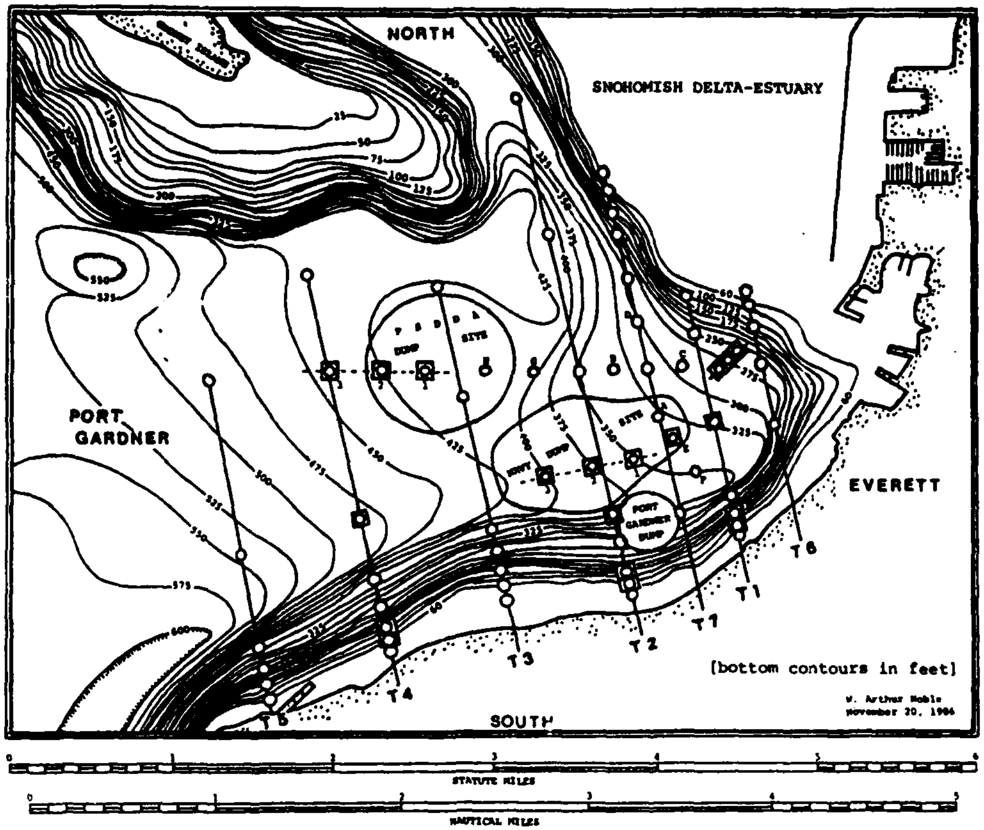
The Elliott Bay monitoring plan has been revised to include baseline biological stations. MPTA, exhibit I reflects the final monitoring plan including approximated locations of sampling stations. The baseline studies of the three preferred sites were conducted in May 1988.

Response 11. See response No. 4 to FWS letter.

Response 12. There is no requirement in the present situation for a worst case analysis. The CEQ regulations for Environmental Impact Statements (EIS) have never required that all EISs contain a worst case analysis and the present regulation has dropped the requirement altogether (40 CFR 1502.22). Case law also does not require a worst case analysis in all EISs. The present regulation at 40 CFR 1502.22 provides that:

> "When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment and there is incomplete or unavailable information the agency shall always make clear that such information is lacking.
>
> (b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because of the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement: (1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonable foreseeable significant adverse impacts on the human environment; and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community . . . ."

The former regulation required a worst case analysis when there were gaps in relevant information or scientific uncertainty. In those cases if the information relevant to the adverse impacts was essential to a reasoned choice among alternatives, and the information was unknown and the overall cost of obtaining the information was exorbitant or the means of obtaining the information was beyond the state-of-the-art, then a worst case analysis was required. The Ninth Circuit essentially adopted the worst case analysis of



Depth contours and dump sites located on map of beam trawl (O) and otter trawl (☐) crab, shrimp and fish Sample Stations shown in Figure 1, Page 2 of Fall Cruise Report, Paul Dinnel et al, School of Fisheries and Fisheries Research Institute, University of Washington, Seattle, October 16, 1986.

WASHINGTON ENVIRONMENTAL COUNCIL

DETAILED COMMENTS

on

PSDDA: Proposed Management Plan for Unconfined Open-Water Disposal of Dredged Material in Central Puget Sound (5 volumes, January 1988)

Page 2-5. Table 2.1. DPMP "Puget Sound Dredged Material Inventory, Phase I Area (Seattle, Tacoma, Everett) 1970-1985."

DREDGE SPOILS UNACCOUNTED FOR IN INVENTORY

The totals for this inventory do not compute.

- The amounts dumped at Port Gardner, Elliott Bay and Commencement Bay fall .686 million cubic yards short of the total spoils volume. Where was this remainder dumped?
- The disposal method tallies fall 478 thousand cubic yards short of the total volume dredged on Corps projects. How was this remainder disposed of?

13

Pages 4-1 and 4-3. DPMP. INACCURATE GRAPHIC DEPICTION

A disposal site in 400 feet of water is depicted as measuring 3,000 feet wide which is -- according to the Corps' own data -- impossibly undersized (i.e., 261,590 cubic yards of dredge *spoils dumped at a* taut-wire-moored buoy in 295 feet of water at the Foul Area disposal site in Massachusetts Bay resulted in an almost uniformly thick deposit -- 0.6-1.6 feet -- 3,280 feet in diameter). [James J. Bajek, Robert W. Morton, Joseph D. Germano and Thomas J. Fredett. Dredged Material Behavior at a Deep Water Open Ocean Disposal Site. U.S. Army Corps of Engineers, New England Division, Science Applications International Corp.]

Page 4-4, Figure 4.3. DPMP. INACCURATE GRAPHIC DEPICTION

This figure depicts the Commencement Bay disposal site under 530 feet of water as measuring only 3,300 feet wide, another impossibility.

These errors, and presumably similar errors in Figures 4.4 and 4.5 (Elliott Bay and Port Gardner disposal sites) must be corrected in the final PSDDA report.

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Page 5-7, Table 5.1. "Alternative Biological Effects Conditions for Management of the Unconfined, Open-Water Disposal Sites." DPMP.

ALTERNATIVE BIOLOGICAL EFFECTS CONDITIONS BASED ON UNVALIDATED STUDIES

The biological conditions described in this table under the categories of Site Conditions I, II, and III" are unacceptable, for they are both based on unvalidated studies and constitute an offensive distortion of the scientific term, "acute toxicity." The entire table should be deleted.

All three categories are based on the Tetra Tech, Inc. "Apparent Effects Threshold" concept developed during their Commencement Bay Superfund Site studies that have never received peer review or

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the old regulation in Oregon Natural Resources Council v. Marsh, 832 F2. 1489 (9th Cir. 1987), petition for cert. filed __ U.S.L.W.__, (U.S. _____ 1988). In that case the court only required a worst case analysis "when there are gaps in the information engendering scientific uncertainty which the agency determines to be important and when the necessary information cannot be obtained because of scientific impossibility or because the costs of obtaining it would be exorbitant" at page 1497.

The situation at hand does not fall within the requirements for a worst case analysis; there are no "gaps in the information engendering scientific uncertainty." Furthermore, the added requirements in the present regulation at 40 CFR 1502.22 do not apply because all information, relevant to the reasonably foreseeable significant adverse impacts on the human environment, has been obtained.

Response 13. Table 2.1 has been corrected.

Response 14. The disposal event referenced in the paper by Bajek, et al. (1987), describing the observed limits of a disposal event at the Foul Area disposal site off the coast of Massachusetts did result in a pancake shaped disposal mound with a diameter of 3,280 feet. Figure 4 of the cited paper shows the locations of each discrete disposal barge at the time it discharged its dredged material, and indicates that the barges dumped material over a 3,000-foot-diameter area rather than at a discrete point near the taut wire-moored buoy. The large spread diameter of the material on the bottom was a function of the randomized barge discharge locations depicted in figure 4 of the above referenced paper. A personal communication with Drs. Tom Freddette and Joseph Germano (Eric Nelson, 1987) indicated that based on their observations at the Foul Area site, they felt that this site could easily accommodate 10 times the material or some 2,615,900 cubic yards of material within the 3,280-foot-diameter disposal site. It should be noted that the disposal activity at the Foul Area site occurred in the open ocean, under severe winter conditions, which made disposal at the buoy extremely difficult. The PSDDA site management plan specifies that all disposal barges will only be allowed to dump material within a 900-foot radius circle known as the disposal zone, which is much less (1,200 feet smaller in diameter) than the disposal zone referenced above. Thus, the disposal mound at each of the central Puget Sound disposal sites will generally be contained well within the disposal site boundaries specified for each site. Dump model runs at various depths and current speeds were used to predict the spread of the dredged material mound on the bottom (see Trawle and Johnson, 1986). These models have been field verified at various dredged material disposal sites and generally confirm the validity of the model for discrete dumps at a given location. The disposal site boundaries are accurate as depicted in the Management Plan Report (MPR) figures 4.3, 4.4, and 4.5 and FEIS, etc. Please see the Disposal Site Selection Technical Appendix (DSSTA) for a complete discussion of the model analysis and the basis for establishing the disposal site impact area and boundaries.

Response 15. See response Nos. 1 and 2 above regarding definitions of "minor adverse" and "acute" and peer review of the AET values.

15

scientific acceptance of analytical quality assurance and control.

EVALUATION OF SEVERITY OF ADVERSE EFFECTS UNSUPPORTED BY SCIENTIFIC EVIDENCE

The claim of "no adverse effects" for Site Condition I is unsupported by scientific evidence; on the contrary, the maximum chemical levels (i.e., ML1) allowed for Condition I (i.e., LC_{60} *acute toxicities) clearly indicate that adverse effects would occur.*

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The claim of "minor adverse effects" for Site Condition II is clearly false as the maximum chemical levels (i.e., ML2) allowed for Condition II can be acutely toxic (up to LC_{60}) to bioassay test organisms (see page II-206, Figure II.11-4, DEP). Concentrations that kill 60% of test specimens within 10 days produce major adverse effects.

The claim of "moderate adverse effects" for Site Condition III is also clearly false as the maximum chemical levels (i.e., ML3) allowed for Condition III are twice those of Condition II, that is, double an already acutely toxic (lethal) concentration.

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Page 7-3. DPMP. "Intensity of monitoring may differ from year to year, based on the volume of dredged material disposal during the year at the site."

MONITORING MUST BE CONSISTENT.

This is unacceptable. The volume of material dumped at a site cannot control the site monitoring program, nor can monitoring programs vary in intensity. Monitoring must be consistent at and between disposal and reference sites; otherwise, the data generated will not be comparable.

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Page 7-7. DPMP. "Analysis of monitoring data consists of either a comparison to guideline values or a statistical comparison of the monitoring data to baseline data."

UNACCEPTABLE.

This proposed approach allows decisions to be based solely on either comparison of chemical data or comparison of biological data, whereas all judgments must be made on both. It is not either-or logic, but a bio-chemical duality, upon which all judgments must be made. It is impossible to routinely monitor the many thousands of serious pollutants in the Sound that may be causing harm to the biota; therefore, monitoring chemical data is, of necessity, incomplete. It is impossible to routinely run toxicity bioassays on all the marine species that are adversely affected; therefore, routine bioassays are, of necessity, incomplete. The chemical data are required to complement the inadequacy of the biological data, and vice-versa.

<u>Response 16</u>. Please see response No. 7 above regarding the definition of "acute" effects and allowable mortality in test results. As noted for SC-II in previous response, SC-I is not "equivalent to ML-1." Biological testing is required when chemical concentrations are less than the ML values. If any of the species indicate toxicity, the material would not meet the SC-I condition. The use of the phrase "no adverse effects" is appropriate for this alternative site condition.

SC-II allows only 30 percent toxicity in a single species relative to reference sediment results. The terms "minor" and "moderate" represent alternative goals for the preferred site condition, and were defined technically during the development of the evaluation procedures.

<u>Response 17</u>. See response No. 10 above.

<u>Response 18</u>. See response No. 6 above.

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The dual biological-chemical monitoring evaluation and decision-making processes are the two, inextricable components of all water quality control programs of any value.

Page 7-7. DPMP. "d. *Offsite Reference Stations.*" "In general, samples from these stations will be archived, and analyzed only if sufficient changes occur at the monitoring stations to warrant a check of the offsite reference station data."

UNACCEPTABLE AND PHYSICALLY IMPOSSIBLE

The evaluation procedure cannot be completed without the analytical data from reference stations available for comparison with monitoring station data. It is impossible to carry out the Corps proposal with reference station samples archived. Moreover, it is impossible, practically speaking, to archive sediment samples for biological tests because they can be stored for no more than 4-6 weeks, even when sealed with a nitrogen gas layer above the sediment surface and kept at 4° C. (See page II-58, DEP.)

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All suggested reference sites (page II-66. DEP) are outside the PSDDA-designated Central Puget Sound Area and, thus, fail to offer accurate comparisons with Central Puget Sound Area dumpsites. Doubtless, data *from* those sites would provide good comparative information for general Sound marine studies; however, a valid monitoring program requires a closer correspondence between dumpsites and reference sites. Central Puget Sound must have its own reference stations.

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Page 9-4. DPMP. ZONE OF POSITIONING ERROR NOT DISPLAYED

Since the Port Gardner site can only use variable-range radar reference points for positioning (Loran-C cannot be used because of electronic interference), what will be the positioning error zone for barge loads dumped at this site?

Please display this zone of positioning error on the Port Gardner Disposal Site map.

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Pages A-1 to A-5. DPMP. RECENCY GUIDELINES UNACCEPTABLE

Proposed recency guidelines that allow 5-7-year-old data to be used for decision-making are unacceptable and must be eliminated.

Proposed recency guidelines that allow 2-year-old data for "surface sediments in areas of active contaminant sources" for decision-making are also unacceptable and must be eliminated.

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<u>Response 19</u>. Offsite Reference Stations, now called "Benchmark" stations are <u>to determine</u> if differences in chemical and biological measurements, noted during monitoring of the disposal site, represent natural or background variation at a similar depth and substrate within the general area. In general, samples from these stations will be archived, and analyzed for tissue chemistry only if sufficient changes occur at the monitoring stations to warrant a check of the offsite reference station data (see Management Plan Report (MPR) chapter 7).

<u>Response 20</u>. See response No. 9 above.

<u>Response 21</u>. The estimated error is 30 to 50 meters. This has been taken <u>into account</u> in establishing the radius of the disposal zone (see MPTA 3.4.3). Figure II.3-1 in the MPTA is a schematic for a disposal zone. It is not appropriate to note positioning error on these figures. This may be done in information provided by DNR to those given disposal site use permits.

<u>Response 22</u>. The recency guidelines represent an administrative or risk man-<u>agement decision</u> concerning the period of time for which data will usually be considered adequate to characterize the sediments. As noted in EPTA, they do not apply when a "changed condition" is known; i.e., when a new discharge source has entered the area, or a spill has taken place. They also are not directly applied to cases where the sediments are settling and require dredging more frequently than the guidelines. With these noted exceptions, and with the added "flexible" application of these guidelines, the recency values are considered to be reasonable and protective.

<u>Response 23</u>. The three specific instances cited (Scott Paper and Weyerhaeuser <u>in Everett</u> and Simpson in Tacoma) are currently within "high concern" ranked areas. All locations with known current or past pulp and paper mills were

Page A-6. Table A.1. DPMP. "Initial Area Rankings in the Phase I Study Area."
INCOMPLETE

Pulp and paper mills that use sulfite or kraft bleaching processes must be included under "High Rankings" (relative to potential for presence of chemicals of concern) because of the high toxicity of their waste discharges (effluent, sludge and boiler emissions), their accumulation in bottom sediments, and the presence of extremely toxic polychlorinated dioxins and furans in these waste streams.

Therefore, Central Puget Sound regions affected by discharges from the following sources must be added to Table A.1 as "High Ranking Areas":

- o Scott Paper Company (sulfite bleach), Everett
- o Weyerhaeuser Company (kraft bleach), Everett
- o Simpson Paper Company (kraft bleach), Tacoma

The seriousness of this situation is indicated by the fact that EPA Region 10 plans to conduct a study of the formation of chlorinated dioxins and their transport (internal) waste streams at 17 Pacific Northwest pulp and paper mills that use bleaching processes. Eleven are in the state of Washington and are the following:

- o Simpson Paper Co., Tacoma
- o Scott Paper Co., Everett
- o Weyerhaeuser Co., Everett
- o Weyerhaeuser Co., Cosmopolis
- o Weyerhaeuser Co., Longview
- o Longview Fibre Co., Longview
- o ITT Rayonier, Inc., Port Angeles
- o ITT Rayonier, Inc., Hoquiam
- o Georgia-Pacific Corp., Bellingham
- o Boise Cascade Corp., Wallula
- o James River Corp., Camas

23

Page A-9. DPMP. BIOLOGICAL TESTING OF ML+ SEDIMENTS UNACCEPTABLE

The option to allow the dredger "to biologically test sediments with chemical concentrations above the maximum level" subverts the entire basis and purpose of establishing maximum sediment criteria and must be eliminated.

24

Pages A-16 and A-17. DPMP. "FOUR INTERPRETATIONS" INCONSISTENT

The "four interpretations" of suitability for open-water disposal include allowing biological testing of sediment up to (but not including) twice the maximum level of contamination, again subverting the entire basis and purpose of maximum sediment criteria, and must be eliminated.

25

ranked "high concern" in the initial ranking of the central basin. We are aware of the EPA study cited and will be utilizing the information generated in our annual reviews of the program and in area ranking for Phase II.

Response 24. See response No. 6 to Suquamish letter.

Comment 25. The ML guideline values are not considered to be indicators of acceptable or suitable material; the contrary is indicated. For any example with chemical concentrations above the SL values, biological testing is required and becomes the sole basis for determining material suitability. If the material additionally exceeds the ML values, biological testing is not advised but remains an option of the dredger. However, biological testing of material with chemical concentrations above the ML values would include both standard and other (e.g., chronic and sublethal) tests.

Glossary, Page 7, DPMP. 209 PCB CONGENERS

Polychlorinated Biphenyls are defined as "A group of man-made organic chemicals, including about 70 different but closely related compounds..." The 70 should be changed to 209, as there are 209 PCB congeners.

26

BIBLIOGRAPHY MISSING

19 citations appear on pages 5-3 (13), 5-4 (2), 5-17 (1), 5-18 (2) and A-17 (1), but there is no bibliography in this document (DPMP). Please provide full citations in the final document.

27

Page ES-15.DEP. "At open-water disposal sites, the chemical pathway of primary concern is the direct contact between organisms and the biologically active surface layer of the bedded dredged material (material below this layer is largely unavailable to organisms."

FALSE

Studies show that burrowing shrimp (*Axiopsis spinulicauda*) and sea cucumbers (*Molpadia*) have ready access to bedded spoils. Turnover rate for the burrowing shrimp (*Callianassa californiensis*) has been measured at two-and-a-half feet of bottom sediment per year.

Furthermore, there are lateral "chemical pathways of primary concern" (e.g., the Sea Surface Microlayer (SSM), pycnoclines and the nepheloid layer) and pervasive "chemical pathways of primary concern" (e.g., the water column and the food chain).

28

Page ES-16. DEP. "...[I]f Site Condition I were applied to unconfined open-water disposal sites, habitat losses and possible adverse effects in confined shore and land sites would be high compared to the deep-water impacts, due to the large volume of dredged material that would be disposed of in the environments."

FALSE

The same volume of material will have an adverse impact in either region. "Large volume" as a cause is spurious logic. Furthermore, land sites allow for treatment and control (e.g., chemical fixation and solidification), whereas aquatic disposal does not.

29

Page ES-16. DEP. "Aquatic effects associated with the disposal of material under Site Condition II guidelines could include sublethal effects at the disposal site and potentially a small (though not significant) increase in the mortality of more sensitive, but less abundant, benthic infauna (e.g., crustaceans)."

FALSE

The above statement must be changed to read, "Condition II guidelines would include sublethal effects at the disposal site and increase the mortality of benthic infauna (e.g., crustaceans)."

30

Page ES-17. DEP. "Condition II is the preferred management condition for unconfined open-water disposal at the central Puget Sound sites."

ARBITRARY AND UNACCEPTABLE

There is no logical or scientific reason presented in this report as to why Condition II should be preferred. We find this choice arbitrary and unacceptable.

31

Response 26. This error has been corrected in the final document.

Response 27. These same citations are made in the EPTA which does provide a list of references (see EPTA, part IV). The MPR is not intended to contain the technical references for the plan conclusions. These are provided in the technical appendixes.

Response 28. We acknowledge that there are some burrowing organisms that can, and will, penetrate the sediments beyond the surface layers. However, these are not considered to be the dominant organisms at the disposal site. Most of the benthic infauna that are expected at the site will be opportunistic colonizers that will remain closer to the surface. Nonetheless, all the material discharged at the site has passed through the evaluation procedures, such that subsurface sediments should present no additional environmental protection concerns.

Discussion of dredged material disposal effects on the sea surface microlayer is provided in section II-2.3.3 of EPTA.

Response 29. Unconfined, deepwater sites were located in low resource areas to minimize impacts to disposal activities as much as practicable. A minimum buffer of 2,500 feet around each deepwater site was established to isolate the site from vulnerable natural resources and human use areas. Nearshore disposal sites are difficult to find, and would generally be located in high concern areas (i.e., special aquatic sites) where potential resources at risk would be high such as seagrass beds, wetlands, and intertidal habitats. Nearshore disposal of dredged material is unacceptable because of the losses of valuable seagrass beds, intertidal and wetlands habitats, all of which are critical foraging and spawning habitats to many fish and invertebrates (juvenile salmonids, flatfish, smelt, crabs, shrimp, shellfish beds, i.e., oysters, mussels, clams, etc.) and waterfowl species. Therefore, the habitat losses associated with placing dredged material in a nearshore habitat would result in unacceptable impacts to aquatic fisheries and wildlife resources. The availability of public multi-use upland sites is unknown. This is being addressed by Ecology in a separate study. The cost of upland confined disposal of relatively clean material is prohibitively expensive (assuming sites are available) due to site preparation and transport costs.

Response 30. See response No. 3 to the NMFS letter.

Response 31. See response No. 3 to the NMFS letter.

Page I-26, Table I.4-2. DEP. "Puget Sound Material Inventory for the Phase I Area (Seattle, Tacoma, Everett) 1970-1985"
TWO ERRORS: THE SAME TABLE AND SAME ERRORS AS ON PAGE 2-5, DPMP.

32

Page II-27, DEP
ERROR IN AND OMISSION OF CITATION
"(Word et. al. 1986)" is not listed in Part IV References section, but it is incorrectly listed under Evans-Hamilton. The correct citation is:

Jack Word, L. S. Word, J. N. McElroy and Ronald M. Thom. 1986. The Surface Microlayer: Review of Literature and Evaluation of Potential Effects of Dredge Activities in Puget Sound. PSDDA Report, prepared by Evans-Hamilton, Inc., Seattle, Washington.

33

Page II-27. DEP
OMISSION OF CITATION
"(Hardy, et. al., 1986" is not listed in Part IV Reference section. The correct citation is:

J. T. Hardy and C. E. Cowan. 1986. Model and Assessment of the Contribution of Dredged Material Disposal to Sea-Surface Contamination in Puget Sound. PSDDA Report, prepared by Battelle's Pacific Northwest Laboratory, Richland, Washington.

34

Page II-27, et. seq. DEP
DEFICIENCY IN CITATIONS
A very important 1987 sea surface microlayer analysis and an an excellent 1986 summary of the biological significance of the SSM should have been mentioned and included in the reference section:

Jack Word, John Hardy, Eric Crecelius and Steve Kiesser. July 1987. U.S. Navy Homeport - Sea Surface Microlayer Analysis: Laboratory Studies of Floatable Contaminants from a Dredged Material Disposal. Prepared for the U.S. Army Corps of Engineers, Seattle District, under a related service agreement with the U.S. Department of Energy Contract DE-AC06-76RLO 1830.

and

John Hardy and Jack Word. 1986. "Contamination of the Water Surface of Puget Sound," Puget Sound Notes, November 1986, U.S. Environmental Protection Agency, Region 10, pp. 3-6.

35

Page II-67. DEP
MISNOMERS
Last paragraph, second line: "*(Crassostrea gigas)*" is incorrectly referred to as the "Pacific oyster," and should be changed to read "Japanese oyster" (see Eugene N. Kozloff. 1973. Seashore Life of Puget Sound, the Strait of Georgia, and the San Juan Archipelago. University of Washington Press, 282 pp.)

36

Response 32. Corrections have been made to this table.

Response 33. Citation has been corrected in the final document.

Response 34. Citation has been corrected in the final document.

Response 35. These citations, released after PSDDA studies of the microlayer, have been added to the *final document*.

Response 36. Comment noted. Text will be changed to reflect that Crassostrea gigas has several synonyms and is called the "*Pacific oyster*" and interchangeably the "Japanese oyster" (R. T. Abbot, 1966. Seashells of North America. Golden Press, New York). Since it is an exotic species introduced from Japan, the latter name is perhaps more appropriate.

Also, the mussel *Mytilus edulis* (as distinct from the coast mussel *Mytilus californianus*) is more properly referred to as the "bay mussel", not the "blue mussel", as stated. 37

Pages II-84 and II-85. DEP
NEGLECT OF ORGANOTIN COMPLEXES (E.G., TBT)
Although the authors admit that organotin complexes

- are of concern in marinas and ship terminals,
- are a problem at parts per trillion,
- should be measured as soon as possible, and
- are present in unknown concentrations in the Sound,

they fail to show any justification for removing them from the PSDDA chemicals of concern and screening/analysis lists. They must be included in both. 38

Page II-85. DEP
NEGLECT OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD)
The authors of the section on TCDD admit that it is an EPA priority pollutant of national concern, but they falsely claim, "[It] has never been confirmed in marine sediment or biological samples from Puget Sound...Other, much less toxic, chlorinated dioxin isomers have been detected in sediments,..." 39
FALSE
EPA's National Bioaccumulation Study (whole-body tissue analyses) of nine starry flounder (bottom-feeding fish) which were captured near the outfall of the Simpson Paper Company mill on Tacoma's Commencement Bay yielded an average of 1.5 parts per trillion (ppt) of TCDD, with a range of 0.2-3.0 ppt of less toxic forms of dioxins and furans. [Samples collected May 13, 1987; EPA news release for Region 10, February 19, 1988]

Page II-81. Table II.7-1. DEP. "Chemicals of Concern"
DELIBERATE EXCLUSIONS UNACCEPTABLE
We view this list of "[PSDDA] Chemicals of Concern" with extreme alarm as it is clearly an attempt both to subvert the water quality control efforts of state and federal agencies and to deny the existence of scientific evidence accumulated over many decades that identifies the major chemicals of concern in aquatic environments. Arbitrarily deleted from the PSDDA list are EPA "Priority Pollutants" and Puget Sound Estuary Program (PSEP) "Chemicals of Concern," including dioxin, the most toxic substance ever tested by EPA, which accumulates in bottom sediments where it remains for decades.

Dioxin is lethal to trout at the minute concentration of less than 38 picograms per liter, that is, less than 38 parts per quadrillion (38:1 000 000 000 000 000). The estimated trout bioconcentration factor for dioxin in its tissues is from 39,000 to 86,000 times above ambient (steady state) conditions. [Paul M. Mehrle et. al., 1987. "Dioxin (TCDD) and Furan (TCDF) Toxicity to Rainbow Trout," Research Information Bulletin No. 87-55, U.S. Fish and Wildlife Service, 3 pp.] 40

Response 37. The generally accepted common name for Mytilus edulis is the common "blue mussel," although it is also known locally by other synonyms such as the "bay mussel" and the "edible mussel."

Response 38. See response No. 17 to NMFS letter.

Response 39. Please see response No. 3 above concerning TCDD and the PSDDA chemicals of concern.

Response 40. Please see response No. 3 above concerning dioxins and the PSDDA chemicals of concern. The response provided above for not including dioxins and butyltins on the PSDDA chemicals of concern list are also applicable to other chemicals absent from the list (though these other chemicals have not been found at levels of concern in sediments from the Sound). We currently do not have toxicity in sediments from the Sound that is "unexplained" or is not identified by the current list of chemicals of concern.

Please see response No. 3 above concerning oil and grease and contamination of the sea surface.

40

Dioxin is also bioconcentrated by shellfish such as crabs and other crustaceans as well.

The consumption of dioxin-contaminated fish and shellfish poses extreme risks to human health. Dioxins (and the closely-related furans) are known to be:

- o carcinogenic (both cancer initiator and cancer promoter)
- o fetotoxic (causing lethal effects in embryos and fetuses),
- o teratogenic (causing formation of fetal monstrosities),
- o immunotoxic (causing suppression of the immune system), and
- o acutely toxic (causing delayed lethal effects).

For example, primate studies conducted by the University of Wisconsin indicate adverse reproductive effects from a diet of only 100 picograms of dioxin per kilogram of (monkey) body weight per day, i.e., 0.000 000 000 001 gram/kg body weight/day. [Seventh International Symposium on Chlorinated Dioxins and Related Compounds, University of Nevada, Las Vegas, October 4-9, 1987.]

Puget Sound fish are known to contain dioxin in their tissues (see note directly preceding).

It is clear that chlorinated dioxins and furans -- their homologues and isomers -- must be included in the final PSDDA Chemicals of Concern list. Furthermore, since chlorinated dioxins and furans are the most toxic of all listed, they should be classified as "chemicals of primary concern" and added to the PSDDA chemicals of concern and screening/analysis lists.

Whereas PCBs are on the "draft PSDDA Chemicals of Concern" list, and PCDDs, PCDFs and PCBs belong to the same molecular class of chemicals (i.e., halogenated aryl hydrocarbons); therefore, the "Final PSDDA Chemicals of Concern" list should include them as unique chemical families, each representing a group of different chemical species (congeners) all under the same class:

Halogenated Aryl Hydrocarbons (HAHs)

- o PCDDs: Polychlorinated dibenzo-p-dioxins (75 congeners)
- o PCDFs: Polychlorinated dibenzofurans (135 congeners)
- o PCBs: Polychlorinated biphenyls (209 congeners)
- o PCNs: Polychlorinated naphthalenes (75 congeners)
- o PCABs: Polychlorinated azo and azoxybenzenes
- o Other families of polychlorinated aryl hydrocarbons
- o Related polybrominated analogues

"The most active PCDDs, PCDFs, PCBs, PCNs and PCABs elicit comparable biologic and toxic effects although their relative potencies are vastly different."

"...[T]he most active compounds are approximate isostereomers of 2,3,7,8-tetrachlorodibenzo-o-dioxin (TCDD), the most toxic halogenated

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aryl hydrocarbon." 2,3,4,8-TCDD is extremely lipophilic (i.e., fat soluble) and, thus, dissolves readily in oil and grease. The most active and toxic PCDD and PCDF congeners have chlorine substituted (i.e., hydrogen atoms replaced by chlorine atoms) in their lateral 2,3,7 and 8 positions. In other words, the most toxic congeners include specific isomers of the tetra-, penta-, hexa- and hepta-homologues of PCDD and PCDF.

The most active and toxic PCB congeners are also chlorine substituted in their lateral positions. In other words, the most toxic congeners include specific isomers of the tetra-, hexa-, and penta-homologues of PCB. [Quoted and paraphrased from S. Safe. 1983. "2,3,7,8-TCDD -- Biochemical Effects," Chemosphere, Volume 12, No. 4/5, pp. 447-451.]

In addition, the following pollutants of major concern to the public and to the aquatic life of the Puget Sound Region -- most of which appear on the EPA priority list and/or on the PSEP list of chemicals of concern -- must also be included in the "Final PSDDA Chemicals of Concern" and screening/analysis lists.

- o Nitrated phenols
- o Nitroso compounds
- o Ethylene dibromide (EDB)
- o Vinyl chloride (chloroethylene)
- o 1,2-trans-dichloroethene
- o organometals (e.g., organotins, organoleads and organomercuries)
- o Oil and grease

It is clear that oil and grease pose extreme environmental risks, not just because they themselves are toxic, but most importantly, because they are solvent to lipid-based pollutants, which comprise 92 of the 129 EPA priority pollutants, including PCDDs and PCBs. In other words, oil and grease concentrate 71% of those pollutants, including the most toxic.

Dredging and disposal operations inevitably release oil and grease from bottom sediments into the water column, where they rise to the surface and are transported by wind and wave action onto the shorelines and beaches of the Sound.

Therefore, the oil and grease fraction represents a major contaminant concentration medium, as well as a major contaminant pathway which poses a direct threat to public health and to the life in the sea surface microlayer (SSM).

Oil and grease must be classified as "chemicals of primary concern" and added to the PSDDA Chemicals of Concern and screening/analysis lists.

NEGLECT OF SEA-SURFACE MICROLAYER CONTAMINATION

The rationale presented for ignoring contamination of the *sea-surface microlayer* is illogical and unacceptable. (See above comments on lethal oil-grease contamination.)

41

Page II-101. DEP. "Data for the following conventional analyses will not be required for dredged material chemical testing:

- o <u>Oil and grease</u>...indicators of some forms of hydrocarbon chemical concentrations;..."

UNACCEPTABLE

The exclusion of oil and grease from required conventional analyses of dredged material is unacceptable. They must be included. They are not merely "...indicators of some forms of hydrocarbon chemical concentrations..." (See comments directly above and also regarding II-27 <u>et</u>. <u>seq</u>.: erroneous judgments, incomplete and inaccurate citations.)

42

Pages II-115 - II-118. Table II.8-4. DEP "Screening and Maximum Level Chemistry Values (January 1988 rev.)";
Pages A-14 and A-15, Table A.7. DPMP. " Screening Level (SL) and Maximum Level (ML) Guideline Chemistry Values (Dry Weight Normalized)".
[<u>n.b.</u>: Table A.7 "ML " = "ML2" of Table II.8-7]

ALARMING LEVELS OF/EXCLUSION OF SPECIFIC CHEMICALS

We also view with extreme alarm the arbitrary exclusion of chemicals *of major concern from* the list of pollutants that will be chemically analyzed and biologically assayed (See Tables II.8-4 DEP and A.7 DPMP) as part of the baseline and monitoring requirements of dredging and disposal activities.

Not only are the above-mentioned chlorinated dioxins, oils and grease, etc. omitted, but also omitted are nine of the draft "PSDDA Chemicals of Concern", which appear in Table II.7-1, DEP, pp. II-81 and II-82, under the heading "Additional Chemicals to be Measured. These nine must be added to the screening/maximum level lists:

- o Chromium
- o Trichlorobutadiene isomers
- o Tetrachlorobutadiene isomers
- o Pentachlorobutadiene isomers
- o 2-methoxyphenol (guaiacol)
- o 3,4,5-trichloroguaiacol
- o 4,5,6-trichloroguaiacol
- o Tetrachloroguaiacol

We find that the enormously high pollutant concentrations proposed as "maximum level" sediment criteria (<u>i.e.</u>, allowed for open-water disposal) pose a severe environmental threat. Of the entire report, these *proposed criteria* are the most offensive and the most frightening. 43

<u>Response 41</u>. Please see response No. 3 above concerning contamination of the sea surface.

<u>Response 42</u>. Please see response No. 3 above concerning oil and grease.

<u>Response 43</u>. Please see response No. 3 above concerning other chemicals not on the PSDDA list.

With the PSDDA evaluation procedures, environmental protection is embodied in the screening level (SL) values. Above the SL values, biological testing is necessary. The proposed SL values are very reliable (highly sensitive), relatively low (usually near reference area concentrations), and conservative (biased to biological testing) values which are considered good indicators of the absence of effects of concern. All chemicals on the PSDDA primary list (58) have SL values, above which biological testing is needed for a decision on unconfined, open-water disposal.

For some of the chemicals of concern, it is currently not possible to define a technically defensible maximum level (ML) value, as predictions of "assured *toxicity" are not reliable with the current data base*. For these chemicals, it will be necessary to continue reliance on biological testing for now.

As discussed in EPTA (II-7.1.1), there are some chemicals of concern only in a few areas of the Sound. These eight chemicals, referred to as "localized chemicals of concern," would be measured only when assessing sediments in those areas. There are insufficient data with which to define defensible SL or ML values. Therefore, if these chemicals are found, a decision on the need for biological testing will necessarily be a case-by-case decision, likely based on presence (except for chromium). As further knowledge is gained, it may be possible to define chemical disposal guidelines for these local chemicals.

The concentration values proposed for the SL and ML guidelines were derived by a detailed analysis of the Puget Sound database. The resulting values were tested to determine their reliability in predicting the absence or presence of adverse biological effects. These tests indicated that the values, as currently proposed, were highly reliable. This assessment step will be a key feature of the annual review of the PSDDA management plan. This will allow alterations to the list of chemicals or to the chemical disposal guidelines to improve the system reliability where possible.

The following are much too high, some by several orders of magnitude: 43

Metals
- o Arsenic 700 ppm
- o Lead 700 ppm
- o Zinc 1,600 ppm

HPAH 18,000 ppb
- o Benoz(a)anthracene 4,500 ppb
- o Benzo(a)pyrene 6,800 ppb
- o Benzo(g,h,i,)perylene 5,400 ppb

Chlorinated hydrocarbons
- o Hexachlorobenzene 230 ppb
- o Total PCBs 2,500 ppb

The following screening levels are much too high:
- o Arsenic 70 ppm
- o Hexachlorobenzene 23 ppb

The following pollutants were listed without any maximum level, which must be established:
- o 1,3-dichlorobenzene
- o Dimethyl phthalate
- o Di-n-butyl phthalate
- o Butyl benzyl phthalate
- o Bis(2-ethylhexyl) phthalate
- o Di-n-octyl phthalate
- o Pentachlorophenol
- o Aldrin
- o Chlordane
- o Dieldrin
- o Heptachlor
- o Lindane

In summary, the proposed Puget Sound sediment criteria (screening levels and maximum levels) are unacceptable because chemicals of primary concern have either been excluded or arbitrarily given extremely high values without any scientific justification or rational basis.

Page A-19. DPMP. "Sediment Chemistry Guideline Values for Bioaccumulation" 44

EXAGGERATED BIOACCUMULATION VALUES

The following bioaccumulation values are much to high and unacceptable:
- o Arsenic 511 ppm
- o Bis(2-ethylhexyl) phthalate 13,870 ppb
- o Pentachlorophenol 1,022 ppb
- o Hexachlorobenzene 168 ppb
- o Trichloroethene 1,168 ppb
- o Total PCBs 1,789 ppb

Response 44. The concentration values listed in the referenced table (and identified in the comment) are values in sediment that would require that sediment specific bioaccumulation tests be conducted. Interpretation of the values measured in tissue (actual bioaccumulation concentrations) would utilize a second set of values for each chemical of human health concern. The rationale for deriving the sediment chemistry guidelines is provided in sections II-6.4.1 and II-8.4 of EPTA.

Page A-24. Table A.9. DPMP. "Target Tissue Concentration Values for Chemicals of Concern to Human Health"

ABSENT POLLUTANTS OF PRIMARY CONCERN/EXAGGERATED TISSUE VALUES

This table is also unacceptable because numerous pollutants of primary concern to human health have been deleted, values presented have not been scientifically justified, and the following human tissue values (i.e., allowed human body burdens) are much too high.

- o Pentachlorophenol 900 ppm
- o Hexachlorobenzene 180 ppm
- o Trichloroethene 127 ppm
- o Chlordane 8.7 ppm

45

Response 45. Please see response No. 44 above concerning tissue chemicals and guidelines.

Page II-121, Table II.8-5. DEP. "Resulting Target Tissue Concentration Values (HI) for Chemicals of Concern to Human Health."

ALARMING LEVELS OF ACCEPTABLE HUMAN TISSUE BODY BURDENS

The "HI" (i.e., Human Indicator) values presented in this table are a euphemism for proposed human body burdens of toxic chemicals that will be allowed to concentrate in our tissues as a result of eating contaminated marine life (e.g., fish and shellfish) from Puget Sound.

Many of the allowed human body burdens proposed are not only offensively high (for example, in parts per thousand,

- o 2.8 of N-nitrosodiphenylaime
- o 3.0 of Phenol
- o 300.0 of Dimethyl phthalate),

but also they are unsupported. The chemicals on this list were computed on fish only -- no shellfish -- and, in the fish, only at the contamination level of the sediment concentration. No bioaccumulation was factored in. The values are preposterous; they must not be allowed.

46

Response 46. Please see response No. 44 above concerning tissue chemicals and guidelines. As described in the previous response, the tissue guidelines for interpreting laboratory bioaccumulation tests are not equivalent to acceptable concentrations in human tissue. They are also not equivalent to acceptable concentrations in seafood consumed by humans. Rather, acceptable concentrations were identified using EPA methods and values, and these were used to derive laboratory interpretation guidelines.

Page II-123. DEP. "Of the 30-day bioaccumulation test results in bioaccumulation levels greater than the *HI* (se Table *II.8-5*), the sediment will not be allowed for unconfined, open-water disposal."

This is also unacceptable for the above reasons.

47

Response 47. Please see response No. 44 above concerning tissue chemicals of concern and related guidelines.

Page II-95. DEP.

EXAGGERATED SCREENING LEVELS

The decision to set the screening level for phthalate esters "...equal to the *highest* AET *for a range of biological indicators* (because phthalates are common laboratory chemicals of concern and a higher screening level may be appropriate)" is contradictory and illogical. Even *if* the AET were an acceptable basis, which it is not (see our general comments, above), the rationale presented dictates that, at the very least, the screening levels should be based on the lowest levels at which no adverse affects are exerted on the complete *range of biological indicators*.

48

Response 48. Phthalates were the subject of extended discussions during development of the PSDDA evaluation procedures. The common industrial use of phthalates (e.g., as a plasticizer) results in the frequent occurrence of laboratory contamination with these chemicals. The lowest AET values occur in the range where laboratory contamination and practical detection limits would often interfere with interpretation of test results. There also remains some debate as to how toxic these chemicals really are. There was initial concern with proposing a different screening level concept for these chemicals. However, in testing the reliability of the resulting numbers, the higher concentration SL values for the phthalates did not affect the environmental sensitivity (the accuracy with which the absence of toxicity is predicted) results.

Page II-96. DEP.
OMISSION OF SCREENING LEVELS FOR POLLUTANTS POSING SIGNIFICANT HEALTH RISKS

The decision not to set screening levels "...for tissue concentrations of semivolatiles, pesticides and PCBs because concentrations estimated to pose a significant health risk may be undetected." is both illogical and unacceptable. Tissue concentrations of chemical pollutants that pose a "significant health risk" must be included. 49

Page II-96. DEP.
OPTIONAL BIOASSAYS ON SUPER-POLLUTED SEDIMENTS

Allowing the dredger the option of conducting bioassays on sediments that contain pollutants above the maximum level concentrations is unacceptable and negates the purpose and meaning of "maximum level." The bioassay organisms and methodologies used do not provide protection for all Puget Sound marine life forms, even at levels of acute, let alone chronic, toxicity. Disposal of material exceeding maximum levels must not be allowed. 50

Page II-96. DEP.
FALLACIOUS JUDGMENTS ON CHEMISTRY VALUES AS SEDIMENT QUALITY INDICATORS

"Bulk chemistry is a valid indicator of sediment quality when chemical concentrations are very low or very high." is an absurd statement: it implies that middle concentrations are invalid indicators of sediment quality. "No single chemistry value can determine both the acceptability and unacceptability of a sediment proposed for disposal at unconfined, open-water sites." is an absurd statement as well: single-chemistry (maximum level) values are the basis of environmental criteria (e.g., water, tissue, food). The following statement, "Hence maximum and screening levels are required." is both gratuitous and illogical. 51

Page II-97. DEP. "There is uncertainty in accuracy of the relationship between concentrations of chemicals and biological effects, and in comparability of data sets within the Puget Sound data base, which implies that the maximum levels should not be used as the sole indicator of the acceptability of dredged material for disposal."

FALSE

The stated implication does not follow from the previous clause. What it does imply is that the entire basis of the Apparent Effects Threshold (AET) is based on:

1) uncertain accuracy of the relationship between concentrations of chemicals and biological effects, and
2) questionable comparability of benthic population data sets in Puget Sound.

This must be added to the fact that the basic rationale for the AET theory has never achieved scientific acceptability (see our general comments, above.) 52

Response 49. We agree with comment; the error in the text has been corrected. Sediment chemical screening levels, sediment chemical concentrations that "trigger" the need for biological tests, and tissue concentration laboratory interpretation guidelines have been provided for semivolatiles and pesticides of human health concern, and for PCB's.

Response 50. See response No. 6 to the Suquamish Tribe letter. The term "maximum level" is intended to define the upper limit of chemical concentrations for which the standard biological tests are a sufficient basis for regulatory decisionmaking. This has been clarified in the MPR and EPTA.

Response 51. The "validity" in using sediment chemical concentrations as part of the PSDDA evaluation procedures is judged by their ability to reliably predict the presence or absence of adverse biological effects (the basis for decisions on dredged material disposal pursuant to the Clean Water Act). At either very low or very high concentrations, the chemistry of the sediment can be a reliable indicator of absence (low concentrations) or presence (high concentrations) of adverse effects. At intermediate concentrations, it is difficult, if not impossible, to reliably predict from chemistry alone the outcome of biological tests. By including the additional step of biological testing and using two chemical guidelines for each chemical, it was not necessary to decide how to resolve the acknowledged uncertainties in relating chemical concentrations to biological effects.

Response 52. Please see response No. 1 above concerning use of the AET approach to deriving PSDDA screening and maximum levels. By adding an "additional buffer" to the AET values (i.e., lower SL values and higher ML values), the resulting guidelines have been shown to be highly reliable for their intended use.

52

Since the entire justification of the screening level (SL) is based on the AET, and the AET is in turn based on uncertain accuracy of chemical-biological relationships and questionable comparability of different benthic population studies in Puget Sound, and since the AET theory is not scientifically validated, then there is no justification for allowing the higher -- maximum level (ML) -- concentration of pollutants to be dumped.

53

Pages II-107 - II-109

ILLEGITIMATE DESIGNATION OF "NO SIGNIFICANT ACUTE TOXICITY" FOR SITE CONDITION II," AND ACUTE TOXICITY BIOASSAYS ASSIGNED LC_{60}.

A lethal concentration in which 60% of the organisms tested are killed (i.e., no one acute sediment toxicity bioassay response greater than or equal to 30% over reference conditions, which may be up to an additional 30% lethality) as a level which defines "no significant acute toxicity" is an offensive attempt to subvert the scientific meaning of "acute toxicity" which is a globally accepted unit of measure and cannot be qualified.

The scientific definition of acute toxicity is the lethal concentration (LC) that will kill 50% of the organisms tested (LC_{50}) of a particular species within a specified length of time (e.g., for 10 days= 10-day LC_{50}).

1) "Acute toxicity" is, by definition, significant.
2) All acute toxicities are the concentrations at which 50% of the test species are killed, i.e., LC_{50}.
3) There is no meaning to "severe acute toxicity." Scientific terms cannot be qualified.

54

DEIS: OMISSION OF WORST-CASE ANALYSIS
This renders the DEIS inadequate and unacceptable.

55

DEIS: OMISSION OF REFERENCE SECTION
Although numerous authors are quoted throughout, the lack of a reference section stymies public and professional review.

56

F I N A L   R E C O M M E N D A T I O N S

Whereas the PSDDA report as a whole rests on a scientifically unaccepted theory (the AET); and whereas the DEIS lacks a required worst-case analysis; and whereas the omission of the reference section from the DEIS prevents adequate comment, the Washington Environmental Council recommends that a corrected Proposed Management Plan using the EP approach, and an adequate EIS, be reissued in draft form for proper review.

* * * * *

Response 53. Please see response No. 7 above concerning the definition of "acute toxicity" in PSDDA.

Response 54. See response No. 12 above.

Response 55. Please see response No. 27 above concerning the citations contained in the PSDDA EIS.

Response 56. Mr. Noble's views are acknowledged.

Testimony by Donald W. Moos

For the Port of Tacoma, Port of Seattle, Port of Everett nd the Ports of Olympia Skagit, Edmonds, Bellingham, Anacortes and Port Angeles, in support of:

Proposed determination of suitability for disposal of dredged material in waters of Central Puget Sound.

My name is Don Moos. I am under contract with the Ports of Tacoma, Seattle, and Everett along with the public ports of Olympia, Bellingham, Anacortes, Port Angeles, Skagit and Edmonds located in the PSDDA Phase II areas.

1

Since the 1984 closures of the 4 Mile Rock and Port Gardner sites, the public ports have been cognizant that there may be no dredge disposal sites available if past practices were to continue. Consequently, the ports have supported the goal of the Puget Sound Dredged Disposal Analysis since its inception in 1985. The goal to provide publicly accepted, environmentally safe, unconfined open water disposal of dredged material in an economically sound and cost effective manner was and is a worthwhile challenge.

The draft Proposed Management Plan and the Environmental Impact Statement being discussed tonight go a long way toward accomplishing that goal.

The four PSDDA agencies, their staffs, the work groups and the leadership of the PSDDA study director are to be commended. The PSDDA project had no precedence; it created a precedence. It did not follow an example; it is an example. The draft plan is a product of two state agencies, two federal agencies, three work groups, a policy review committee, a technical steering committee and dozens of other agency personnel and interested parties. Some cynics might say the product turned out pretty good in spite of that. In my opinion it turned out very good because of that.

2

Is it possible under the aforementioned draft plan for anyone to judge absolutely if the evaluation procedures for testing sediment contamination are stringent enough to prevent degradation of Puget Sound? On the other hand are the evaluation procedures so stringent that dredging will become relegated to history in Puget Sound? The answer to the first question is while not absolutely, the probability is high that the environment is more than adequately protected. The answer to the second question is no but that less dredged material disposed in Puget Sound is likely compared to the past because of the greater regulatory restrictions. However, the results and success of the projected monitoring program should provide definitive answers to both questions. The public ports support a comprehensive monitoring program and yearly reviews of the data by the PSDDA agencies. The evaluation procedures can and should be evaluated and adjusted accordingly in either direction if the monitoring evidence is conclusive.

3

The public ports support the development of a data management system as described in the draft plan. Such a system can be instrumental in assisting the agencies over the years to review and re-evaluate the many required PSDDA procedures. The ports are pleased that project costs, including laboratory testing, are included as pertinent information in the data management program.

The public ports support the development of a user's manual. The additional requirements imposed by PSDDA on the dredging community will be both costly and complex. A users manual will reduce the degree of initial shock to a first time dredger and help guide him through the PSDDA process.

The necessary processes by the State of Washington to activate an effective monitoring program, and a functional users handbook should be established by rule and regulation and become part of the Washington Administrative Code. Disposal site user fees and the guidelines for the expenditure of the funds should likewise be established according to the State's administrative procedures act. 4

Implementation of the management plan by the PSDDA federal and state agencies should be addressed in memorandums of agreement. In order to insure long-term commitment by these agencies in carrying out their respective responsibilities as identified in Chapter 9 of the Policy Management Program Report. 6

Dredging of waterways can be likened to the building of freeways and maintenance dredging compares to road maintenance. Both are essential in carrying out day-to-day commerce and people movement. Three of the public ports effected by this document produce in excess of 75,000 jobs and more than $4 billion in annual business volume. There are some 50 miles of navigation channels and about 50 miles of port terminal ship berths in Puget Sound that have been dredged. In addition more than 200 small boat harbors must be periodically dredged to maintain commercial and recreational facilities. Over the period of 1970-1985, an estimated 26 million cubic yards of sediments were removed from Puget Sound harbors and waterways by various dredgers. To place the total affected area of this activity into some perspective, periodic dredging in the Phase 1 area for navigation improvement and maintenance occurred in less than two square miles of the total 2,500 square mile surface of Puget Sound.

Dredging and disposal costs have increased significantly since 1975. This increase in costs reflects a number of factors, including inflation, fuel costs and lack of available disposal sites. Present dredging and disposal costs of $2.50 to $3.00 a cubic yard compare to 1975 costs that averaged about $1.00 per cubic yard. PSDDA testing costs of the material could amount to an additional $.26 to $1.00 per cubic yard. 6

These costs multiply into millions of dollars on many dredging projects. 'T is ironic that those who are required to dredge do so in an unnatural contaminated environment usually not of their making.

Regardless of such apparent inequities, the public ports' expectation of PSDDA is positive. The prospects of reducing the toxic sediment level in Puget Sound are encouraging. The efforts of the Puget Sound Water Quality Authority and others in the long term should reduce the costs of the dredged material disposal as sources of overall pollution are reduced. We hope the prospect of cost effectiveness in future dredge operations will be equally encouraging. 7

Post Office Box 1518
Olympia, Wa. 98507
Telephone 206/943-0760
Donald R. White Executive Director

STATEMENT

to

U.S. Army corps of Engineers, Seattle District
U.S. Environmental Protection Agency, Region X
Washington State Department of Natural Resources
Washington State Department of Ecology

February 10, 1988

Public Hearing on the

PUGET SOUND DREDGED DISPOSAL ANALYSIS
(PSDDA)

Supporting

Draft Report - Proposed Management Plan for
Unconfined, Open-Water Disposal of Dredged Material
Phase I (Central Puget Sound)

Presented by: Donald R. White
Executive Director
Washington Public Ports Association
Olympia, Washington

Testimony supporting the Phase I Proposed Management Plan/Draft EIS
Seattle Corps of Engineers
February 10, 1988

Thank you.

My name is Donald White, Executive Director of the Washington Public Ports Association which is the service liaison and coordinating agency for public port districts in the State of Washington, with offices in Olympia. The Association represents 62 public ports located in 33 of our 39 counties.

In order to maintain a strong maritime industry we must be able to develop new facilities and maintain and improve existing operations. A cost effective and environmentally safe dredging program is a necessary element of this capability.

The Washington Public Ports Association has been following the PSDDA process very closely during the last three years. We believe that the PSDDA selection of open water disposal sites has been correctly evaluated and is thoroughly sound. We also believe the proposed evaluation procedures and management program are more than adquate to protect the marine environment. The measures being provided to periodically re-evaluate the program's effectiveness is commendable.

The Washington Public Ports Association supports the draft environmental impact statement and the proposed management plan for un-confined open water disposal of dredged material. Early implementation of the PSDDA procedures will be of great value in maintaining the viability of our maritime industry.

The Association will continue to work with appropriate local, state and Federal agencies to assure that member ports can continue to fulfill the legislative mandate of serving as the single local governmental entity responsible for developing international trade.

Thank you.

WASHINGTON PUBLIC PORTS ASSOCIATION
Post Office Box 1518
Olympia, Wa. 98507
Telephone 206/943-0760
Donald R. White Executive Director

STATEMENT

to

U.S. Army corps of Engineers, Seattle District
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The Washington Public Ports Association supports the draft environmental impact statement and the proposed management plan for un-confined open water disposal of dredged material. Early implementation of the PSDDA procedures will be of great value in maintaining the viability of our maritime industry.

The Association will continue to work with appropriate local, state and Federal agencies to assure that member ports can continue to fulfill the legislative mandate of serving as the single local governmental entity responsible for developing international trade.

Thank you.

PUBLIC MEETING TESTIMONY - 10 FEBRUARY 1988
SEATTLE, WASHINGTON

With the exception of the Washington Public Ports Association (WPPA) all testimony given at the Seattle public meeting was oral. Oral testimony is summarized. *Responses* to written and oral comments are given in this section.

RESPONSE TO WPPA TESTIMONY BY DON MOOS

Response 1. Comment acknowledged.

Response 2. Comment acknowledged. See response No. 1 to Port of Tacoma letter.

Response 3. Comments acknowledged. See response No. 3 to Port of Everett 1 March 1988 letter.

Response 4. Comment acknowledged.

Response 5. Comment acknowledged. PSDDA agencies are committed to the full implementation of the PSDDA management plan. See MPR chapter 9. Memorandums of agreement are not anticipated as being necessary to ensure long-term commitment to the PSDDA plan. Each of the four PSDDA agencies have a built-in incentive to continue the cooperative approach.

Response 6. Comments acknowledged.

Response 7. Comments acknowledged.

MR. JIM HEIL

Comment 1. Study is "pretty good."

Comment 2. In the past offsite dumping occurred at the Fourmile Rock site. The Elliott Bay preferred site is acceptable as it will allow better accountability since dumping there will be more visible to more of the public.

Comment 3. "Professional judgement" called *for* in the PSDDA documents where the guidlines are unable to be specific, needs to be exercised with care to avoid lessening environmental protection.

Comment 4. The microlayer and floatable debris issues need to be further addressed in the future.

Response 1. Comment appreciated.

Response 2. Comment acknowledged.

Response 3. We agree. Professional judgment will be a collective involvement of the Corps, EPA, Ecology, and DNR for sediment testing and a determination of acceptability for unconfined, open-water disposal. All PSDDA agencies will exercise professional judgment in mutual interest elements of the PSDDA plan with usually a concensus required for a project to use one of the PSDDA disposal sites. The PSDDA plan, with its comprehensive and detailed guidelines, has substantially reduced but not eliminated the need for professional judgment.

Response 4. We agree that the sea surface micro layer merits additional study (see response No. 3 to Art Noble letter).

MR. DOUG HOTCHKISS - PORT OF SEATTLE

Comment 1. Supported reestablishment of disposal site in Elliott Bay. Preferred site is acceptable to Port of Seattle.

Comment 2. PSDDA plan is reasonable balance between conflicting views.

Comment 3. PSDDA dredged material evaluation procedures are a reasonable first compromise although they may be unreasonably restrictive. Regular reevaluations of procedures are needed.

Comment 4. PSDDA management plan should link monitoring with periodic review of evaluation procedures.

Comment 5. Port of Seattle supports PSDDA management plan.

Response 1. Comment acknowledged

Response 2. Comment acknowledged.

Response 3. Comment acknowledged. Annual reviews will be conducted of monitoring data and data generated by PSDDA dredged material evaluations. See reponse No. 1 to Port of Everett March 11, 1988 letter.

Response 4. See response No. 3 above.

Response 5. Comment acknowledged.

MR. KENT M. BARNARD - ARGONAUT SOCIETY

Comment 1. Shipwrecks, which may lie within the preferred disposal sites, need to be given more consideraton than they apparently have been.

Comment 2. Argonaut Society, a nonprofit organization, has extensive information on Puget Sound shipwrecks. This information suggests the possibility of the presence of two historically significant vessels within the Commencement Bay and Elliott Bay preferred disposal sites.

Comment 3. New state legislation is pending on shipwrecks.

Response 1. Agree. This was done subsequent to the February 10, 1988 public meeting. See response to Advisory Council on Historic Preservation letter and response to Department of Community Development, Office of Archaeology and Historic Preservation letter.

Response 2. Acknowledged. Argonaut Society became a subcontractor in additional shipwreck studies conducted subsequent to the February 10 public meeting.

Response 3. Acknowledged.

MR. GARY D. SERUSON - ARGONAUT SOCIETY

Comment 1. PSDDA study did not give historical properties enough attention.

Comment 2. Unacceptable adverse effects to shipwrecks should also be avoided.

Response 1. See response No. 1 to Mr. Barnard.

Response 2. Agree. See response No. 1 to Mr. Barnard.

RESPONSE TO WRITTEN STATEMENT READ BY MR. DARREL K. RUSSELL, WPPA

Response. Comments acknowledged.

MS. NANCY J. DEBASTE - MAGNOLIA COMMUNITY CLUB

Comment 1. PSDDA efforts appreciated.

Comment 2. Magnolia Community Club strongly opposed to consideration of further dumping at Fourmile Rock disposal site. Too much offsite dumping has occurred in the past.

Comment 3. Use of any disposal site should be subject to stringent controls. Puget Sound pilots should be used to ensure proper navigation.

Comment 4. A dredged material sampling testing record trail should be maintained.

Comment 5. Could independent consultants or University of Washington be employed to check the dredged material proposed for in-water disposal.

Response 1. Comment acknowledged.

Response 2. Acknowledged.

Response 3. We agree. The PSDDA plan provides for management of disposal site use. However, we do not now see a need for use of special pilots.

Response 4. Quality assurance-quality control (QA/QC) procedures have been established to ensure the proper care of sampling and testing data that will be used in regulatory decisionmaking.

Response 5. Rechecking of properly obtained testing data is not required. QA/QC procedures have been established to ensure reliability of data used in decisionmaking.

MS. URSULA A. JUDKINS - MAGNOLIA COMMUNITY CLUB

Comment. Opposed to further use of the Fourmile Rock disposal site or even consideration of the site as an alternative.

Response. Comment acknowledged.

MS. POLLY DYER - PUGET SOUND ALLIANCE (PSA)

Comment 1. PSA was involved in getting PSDDA study initiated.

Comment 2. PSA written comments still under preparation at time of public meeting. May need until March 15 to complete review and provide comments to study director.

Comment 3. Cursory review suggests that PSDDA study to be a good effort.

Response 1. Comment acknowledged.

Response 2. Informal extension granted. Written comments received March 9, 1988. See PSA letter.

Response 3. Comment acknowledged.

MS. LESLIE SACHA - PORT OF TACOMA

Comment 1. Written comments being prepared.

Comment 2. PSDDA agencies complimented for PSDDA study.

Comment 3. Strongly supported Commencement Bay preferred disposal site.

Comment 4. After June 1988 there will be no disposal site available in central Puget Sound.

Comment 5. DEIS is adequate as a basis for decisionmaking. PSDDA agencies did attempt to balance environmental protection concerns with economic impact considerations. However, when in doubt the agencies appeared to go conservative in protecting the environment.

Comment 6. Dredging is very important to the Port of Tacoma for not only maintenance of existing waterways but for new terminals too.

Comment 7. Disposal sites must be environmentally sound and available to dredgers.

Comment 8. The regulatory process takes too long with 6 to 9 months required to get a disposal permit.

Comment 9. Ports should be allowed to participate in annual PSDDA data reviews and plan updates. Changes to the plan should be accomplished by using an advisory committee similar to the State of Washington's Solid Waste Activity Council.

Comment 10. Port of Tacoma (POT) feels that sampling and testing costs will be higher than projected by the PSDDA study and that more dredged material will fail than estimated tests for unconfined, open-water disposal.

Comment 11. Material not suitable for unconfined, open-water disposal must be addressed by the regulatory agencies as soon as possible. POT cannot wait until 1994 for a multiuser confined disposal site.

Comment 12. Dredged material disposal is more than a dredger problem.

Response 1. Acknowledged. See POT letter.

Response 2. Comment acknowledged.

Response 3. Comment acknowledged.

Response 4. Comment acknowledged.

Response 5. Comment acknowledged.

Response 6. Comment acknowledged.

Response 7. Comment acknowledged.

Response 8. Comment acknowledged. PSDDA should help reduce the time required for obtaining disposal permits.

Response 9. The management plan report has been revised to make this clearer to Port of Tacoma letter. Also see response No. 11 to POT letter.

Response 10. Comment acknowledged. See response No. 5 to POT letter.

Response 11. See response Nos. 13 and 14 to POT letter.

Response 12. Comment acknowledged.

MR. BOB H. MORTON - COMMERCIAL FISHERMAN

Comment 1. He employs 125 people at properties located along the Duwamish River. Some of the commercial boats rest on the bottom of the waterway when the tide is out. Dredging is urgently needed.

Comment 2. His firm has suffered economic costs due to problems of too shallow water conditions stemming from an inability to dredge. He asked that the PSDDA agencies expedite the process leading to an Elliott Bay disposal site.

Response 1. Comment acknowledged.

Response 2. Comment acknowledged. PSDDA agencies are proceeding as rapidly as possible to ensure the earliest availability of disposal sites. However, the process leading to a shoreline permit from the city of Seattle must be followed.

MR. DENNIS GREGOIRE - PORT OF EVERETT.

Comment 1. Port of Everett is pleased with the basic premise of the PSDDA study and endorses the selection of the preferred Port Gardner disposal site.

Comment 2. Agree with POT and POS comments.

Response 1. Comment acknowledged.

Response 2. See above responses to POT and POS comments given at public meeting and responses to POT and POS written comments. Also see responses to Port of Everett written comments.

MS. JANICE MILLER

Comment 1. Totally opposed to dumping of any material that is toxic.

Comment 2. According to NOAA studies PSDDA will allow high toxic material to be disposed in Puget Sound. Therefore, no dumping is the preferred alternative.

Response 1. See responses to written comments from Bob and Janice Miller.

Response 2. See responses to written comments from the Millers.

MS. NANCY R. MULONGREN

Comment 1. Concerned over past dumping at Fourmile Rock disposal site. This site should never be reopened.

Comment 2. All testing and monitoring should be done carefully.

Comment 3. Laboratories performing the PSDDA tests should be periodically checked.

Comment 4. Dredgers should accept the need for additional protection of Puget Sound and the additional costs of using the Sound for disposal.

Response 1. Comment acknowledged.

Response 2. Agree.

Response 3. PSDDA agencies will seek adequate quality assurance from laboratories by specifying testing protocols and requiring submittal of detailed QA/QC data.

Response 4. Comment acknowledged.

PUBLIC MEETING TESTIMONY - 11 FEBRUARY 1988
PORT TOWNSEND, WASHINGTON

MR. DON MOOS - WPPA

See comments and responses for February 10, 1988 public meeting.

DR. PAT WENNEKENS - SIERRA CLUB

Comment 1. PSDDA documents difficult to understand.

Comment 2. Will PSDDA program meet State water quality standards?

Response 1. Comment acknowledged. PSDDA documents revised to improve clarity.

Response 2. PSDDA plan requires that dredged material approved for disposal at PSDDA sites meet State water quality standards. Plan is consistent with all Federal and State laws. (See Dr. Wenneken's letter for detailed comments and the PSDDA agency responses.)

MR. ED OWEN - LONE STAR NORTHWEST

Comment 1. Four of the five waterfront sites used by Lone Star Northwest are in need of maintenance dredging. Unconfined, open-water sites are therefore very important and should be made available as soon as possible.

Comment 2. Private companies should also be given an opportunity to participate in the annual PSDDA management plan review.

Comment 3. Willing to accept the PSDDA evaluation procedure as part of doing business. Procedures appear to make good sense.

Response 1. Situation acknowledged.

Response 2. All those wishing to participate in annual reviews will be given an opportunity to do so.

Response 3. Comment acknowledged.

EXHIBIT D

OTHER PERTINENT CORRESPONDENCE

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE SUITE 350
PORTLAND OREGON 97232-2279
(503) 230 5400

F/NWR5:270

FEB 13 1987

Colonel Philip L. Hall
District Engineer, Seattle District
Corps of Engineers
P. O. Box 3755
Seattle, Washington 98124

Re: Puget Sound Dredged Disposal Analysis (PSDDA) Preliminary Draft Summary Report and Draft EIS for the Phase I Area (centeral Puget Sound)

Dear Colonel Hall:

We have completed our review of the preliminary Draft Summary Report and Draft Environmental Impact Statement referenced above and offer no objections to its contents or conclusions at this time. We believe the preferred program alternatives developed by the PSDDA study team with assistance from other agencies will minimize potential impacts to valuable fisheries resources, adequately monitor disposal site and adjacent area impacts and ensure that unacceptable effects are corrected through site management programs.

Thank you for the opportunity to provide comments regarding the potential environmental consequences associated with this proposed program. If you have any questions regarding our comments, please contact Rob Jones of my staff at (503) 230-5429.

Sincerely,

Dale R. Evans

Dale R. Evans
Division Chief

cc: Washington Department of Fisheries
Washington Department of Game
Washington Department of Ecology
Fish and Wildlife Service, ES, Olympia
Environmental Protection Agency

cc

THE TULALIP TRIBES

6700 TOTEM BEACH ROAD
MARYSVILLE, WA 98270
653-4585

26 April 1988

Mr. Frank Urabeck, Program Manager
Puget Sound Dredged Disposal Analysis
c/o U. S. Army Corps of Engineers
P. O. Box C-3755
Seattle, WA

Re: PSSDA Presentation to the Tulalip Fisheries Advisory Commission

Thank you for taking the time on 20 April 1988 to speak with our Commission on issues relating to the on-going dredged disposal program for Puget Sound. Your presentation was very helpful in developing our understanding and position on the dredge disposal issues in Port Gardner.

As we indicated during the meeting, placement of dredged material would be preferable away from our fishing activities, i.e. in Saratoga Passage. However, it is recognized that the costs of disposing of materialsin Saratoga Passage is substantially higher. Your discussion of the West Gedney Island site proposed earlier by Tribal Staff clarified the reasons that this site is unacceptable and why your preferred alternative was developed.

Of primary concern to the fisheries interests of the Tribes in relation to your program is the potential for interference and/or conflicts with our fishing activities. We understand that the materials to be deposited at the proposed disposal site will be extensively evaluated and monitored to ensure minimal impacts to the water column and to the bottom resources. Further, as you indicated, it will be possible to limit disposal activity to periods of time when Tribal fishermen are not fishing through coordination between our Fisheries Department and the Washington Department of Natural Resources. If this is indeed the case, the Fisheries Advisory Commission will convey to the Board of Directors that they have no objection to your proposed site.

Again, we appreciated your informative presentation. We look forward to continued cooperation between the Commission and your agency.

Sincerely,
Bill Gobin

Bill Gobin
Vice Chairman
Tulalip Fish Advisory Commission

APR 29 1988

Planning Branch (1110-2-1150b)

Mr. Jacob Thomas
State Historic Preservation Officer
Office of Archaeology and Historic Preservation
Department of Community Development
111 West 21st Ave, Mailstop KL-11
Olympia, Washington 98504-5411

Dear Mr. Thomas:

This letter reviews Puget Sound Dredged Disposal Analysis (PSDDA) study coordination activities with your office relating to compliance with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act (NHPA). I am requesting confirmation of mutual understandings regarding our progress toward Section 106 compliance so that we may finalize our environmental impact statement (EIS) and supporting documents for the Phase I area (central Puget Sound).

On January 6, 1988, the U.S. Army Corps of Engineers (Corps), on behalf of the PSDDA agencies, transmitted for your review and comment a draft EIS describing selection of three preferred PSDDA sites for unconfined, open-water disposal of dredged material. In your letter of February 5, 1988, you expressed concern for the extent of documentation of submerged historic properties at these sites. You also requested that the Corps consider a Memorandum of Agreement (MOA) to implement consultation under Section 106 of NHPA. By letter dated February 17, 1988, the Advisory Council on Historic Preservation (ACHP) expressed similar concerns.

Subsequently, my staff has worked closely with your office, and we have undertaken expanded literature searches and additional field (sidescan sonar) investigations of each of the three preferred disposal sites. These sites are located in Elliott Bay (Seattle), Port Gardner (Everett) and Commencement Bay (Tacoma). In an interagency meeting on March 25, 1988, our consultants, Evans-Hamilton, Inc. and the Underwater Archaeology Consortium, Inc., presented preliminary findings and recommendations. During this meeting, PSDDA agencies discussed possible further courses of action with Dr. Rob Whitlam of your staff.

The following summarizes the current status of our historic resource investigations. The preliminary report concludes that no submerged vessels are present at either the Port Gardner or Commencement Bay disposal sites.

The Elliott Bay site contains five sonar "targets" representing possible submerged vessels. One (target 3) is identified as the A.J. Fuller, and is presumed to be eligible for the National Register of Historic Places. This vessel is outside the disposal zone. Target 5, tentatively identified as the Multnomah and possibly eligible for the National Register, is near enough to the present zone boundary that it is possible some dredged material might land directly upon it. The three other objects recorded by the sonar have not been correlated with any known vessels. Of the three, two are outside and one (target 4) is inside the disposal zone. Targets 4 and 5 could thus sustain direct impacts, while vessels located further away from the disposal zone would be gradually buried over the 40 or more years that the site would be used.

The PSDDA agencies have evaluated various means to avoid direct impacts. Two options are being considered to protect target 5: (a) move the location of the disposal zone 375 feet south-southwest of the present zone or (b) restrict access by dredgers to the northern segment of the disposal zone. Due to other resource conflicts it is not feasible to move the disposal zone enough to avoid target 4, which is of unknown historic significance.

Based on current bibliographic information, my staff has concluded that a Determination of Eligibility for the National Register is appropriate for target 3 (the Fuller). We propose to enter into an MOA with your office and with the ACHP as soon as possible, presenting our plan of action regarding all five targets that have been found on the site. The proposed plan has been discussed with your office and the ACHP. There is tentative agreement that implementation of the plan would constitute mitigation for disposal effects that could occur to eligible submerged properties and meet the compliance requirements under Section 106 of NHPA.

Plan of Action. The PSDDA agencies will retain a contractor who will attempt, through an underwater remotely operated vehicle (ROV), to videorecord all five sonar targets. A professionally qualified marine archeologist will monitor the ROV activity and evaluate the recordings. The recordings of the targets will be reviewed for historical significance by my staff. The ROV activity will be performed in June after the spring runoff period is over. If an initial test of the ROV system is successful we will record all five targets. Those which in the opinion of my staff meet National Register eligibility criteria will be fully documented. Those which do not will be minimally recorded. If the ROV images are not adequate due to site conditions or if more than 10 field days of effort are required, the ROV work will be terminated. We will view targets 4, 3, 5, 6, and 12 in that order, assuming the test is successful.

If the ROV reconnaissance reveals that the tentatively identified Multnomah or other vessels are eligible for the National Register, we will prepare Determinations of Eligibility and Effect for them. If the ROV test is not successful, we will complete an expanded historical records research on the Fuller and Multnomah.

My staff has also discussed our concerns regarding the schedule for opening the Elliott Bay disposal site in relation to the Section 106 compliance process. We anticipate that a shoreline permit could be granted by the city of Seattle to the Washington Department of Natural Resources for the Elliott Bay site by August 1, 1988. While the permit ROV recording of eligible ships would be completed before the permit is granted by the city, the expanded records research and Determinations of Eligibility and Effect may not be completed until later. It is my understanding that an MOA should be signed by both your office and the ACHP prior to filing the Record of Decision (ROD). Federal actions leading to disposal at the site can follow filing of the ROD. Also, I understand that an MOA need only stipulate the plan of action leading to full compliance with Section 106. Accordingly, we are now preparing an MOA based on this understanding.

As the Determinations of Eligibility and Effect for the Fuller and the MOA will not be available to you until after May 12 when the PSDDA EIS is scheduled to be sent to the printer, I ask that you confirm the foregoing by letter to Mr. Frank Urabeck, PSDDA Study Director, by May 6, 1988. This will permit us to present the status of coordination in the final EIS.

If you have questions or comments, please direct them to Mr. Urabeck at telephone (206) 764-3708, or Mr. David Munsell, Staff Archeologist, at telephone (206) 764-3630.

Sincerely,

RANCE H. ROUNTREE
Lt. Colonel, Corps of Engineers
Acting Commander

Enclosures

Copies Furnished:
(see next page)

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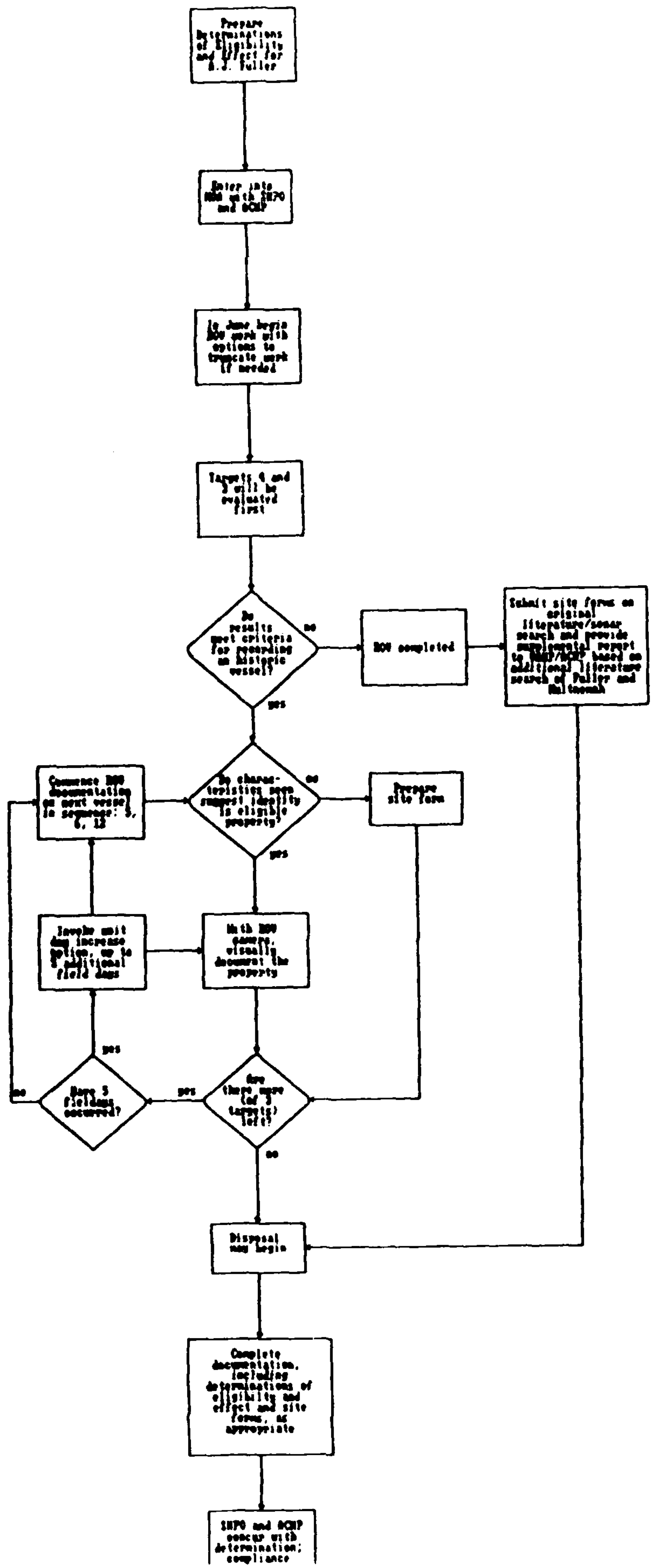
routing and cc's see next page


Prepare Determinations of Eligibility and Effect for Fuller
Enter into MOA with SHPO and ACHP
In June begin ROV work with options to truncate work if needed
Targets 4 and 3 will be evaluated first
Do results meet criteria for recording an historic vessel?
no
yes
ROV completed
Submit site forms on original literature/sonar search and provide supplemental report to SHPO/ACHP based on additional literature search of Fuller and Multnomah
Do charac-teristics seen suggest identity is eligible property?
no
yes
Prepare site form
Commence ROV documentation on next vessel in sequence: 3, 6, 12
Invoke unit day increase option, up to 5 additional field days
With ROV camera, visually document the property
Have 5 fielddays occurred?
yes
no
Are there more (of 3 targets) left?
yes
no
Disposal may begin
Complete documentation, including determinations of eligibility and effect and site forms, as appropriate
SHPO and ACHP concur with determination; compliance

CHUCK CLARKE
Director

STATE OF WASHINGTON
DEPARTMENT OF COMMUNITY DEVELOPMENT
OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION
111 West Twenty-First Avenue, KL-11 • Olympia, Washington 98504-5411 • (206) 753-4011 • SCAN 234-4011

May 9, 1988

Colonel Phillip Hall
Department of the Army
Seattle District, COE
P.O. Box C-3755
Seattle, WA 98124-2255

Log Reference: 1008-F-COE-S-04
Re: Puget Sound Dredged Analysis (PSDDA)

Dear Colonel Hall:

We have reviewed the letter of April 29, 1988, from Lt. Colonel Rance Rountree, and your proposed plan of action for the Puget Sound Dredged Disposal Analysis (PSDDA) compliance with Section 106 of the National Historic Preservation Act.

We concur with the preliminary information from your archaeological and prehistoric sensing research that suggest the A.J. Fuller may be eligible for the National Register of Historic Places. We concur with your plan of action and agree that implementation of this plan should satisfy the Section 106 requirements. Also, based on discussions with the Advisory Council on Historic Preservation, we agree that the completion of an MOA (as outlined in your letter) and the ROV reconnaissance there is no reason why your record of decision cannot be filed and the Elliot Bay disposal site made available for use. We look forward to finalizing the proposed Memorandum of Agreement.

Please feel free to contact us should you have any questions. We look forward to working with you on the ROV activities.

Sincerely,

Jacob E. Thomas

Jacob E. Thomas
State Historic Preservation Officer

mr

cc: Robert Fink

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E.
BIN C15700 Bldg. 1
Seattle, WA 98115

MAY 9 1988

F/NWR5

Mr. Frank Urabeck, Director
Puget Sound Dredged Disposal Analysis Study
U.S. Army Corps of Engineers
Seattle District
P.O. Box C-3755
Seattle, WA 98124-2255

Re: Draft Response of April 29, 1988 to National Marine Fisheries Service March 24, 1988 Comments Concerning the Puget Sound Dredged Disposal Analysis Phase I Draft Environmental Impact Statement and Technical Appendices

Dear Mr. Urabeck:

Per your request, the National Marine Fisheries Service (NMFS) has reviewed your draft response and offers the following comments to supplement our March 24, 1988 letter regarding the Puget Sound Dredged Disposal Analysis (PSDDA) Phase I draft comments referenced above.

NMFS acknowledges the need for and supports the development of an open-water dredged material disposal program as an available alternative for the management of such materials in Puget Sound. In this regard, we commend the concerted efforts of the principal PSDDA agencies to accommodate the economic development of the Puget Sound region in an environmentally acceptable manner.

We believe the designation of specific disposal sites in each of the major urban embayments of Puget Sound (Commencement, Elliott, and Port Gardner Bays), is necessary to provide regulatory agencies and resource managers with both immediate and long term practicable dredged material disposal alternatives. We concur with the selection of the preferred disposal site at each of these locations subject to the concerns expressed in our March 24, 1988 letter.

The implementation of PSDDA guidelines that limit disposal activities to sediments that pose no adverse impacts to aquatic organisms facilitating the preservation, restoration, and enhancement of Puget Sound's estuarine resource remains our primary objective. Considering the importance of these resources to the socio-economic welfare of Washington State, we believe the protection of aquatic ecosystems in Puget Sound should be afforded priority consideration by the PSDDA program. With this objective in mind, NMFS:

1. Is prepared to review proposals carefully in Site Conditions 1 and 2 on a case-by-case basis to evaluate the potential impact from open water disposal. We recognize that a determination will be necessary "that there is no practicable alternative before open-water disposal can be allowed" (as stated in your draft response) to avoid unnecessary adverse impacts to important public trust resources. (In accordance with regulations promulgated pursuant to Section 404 of the Clean Water Act and the National Environmental Policy Act.)

2. Concurs with your draft response which states "there is a need for better biological testing to fully assess chronic and sublethal effects of sediment chemicals of concern". We intend independently to continue our development of scientifically acceptable sediment bioassay techniques to improve sediment testing and monitoring programs aimed at protecting aquatic resources. Our results will be made available for possible use in the PSDDA program.

Thank you for this additional opportunity to express our position concerning key elements of the proposed PSDDA management program. If you have any questions concerning the contents of this letter, please contact Merritt Tuttle of my staff at (503) 230-5424.

Sincerely,

Thomas E. Kruse

for Rolland A. Schmitten
Regional Director

END